The Welding Engineer

Reg. U. S. Pat. Office

Founded by L. B. Mackenzie, 1916

OCTOBER, 1928 VOL. 13, NO. 10

$3.00 per year in U. S. 608 S. Dearborn St., Chicago, Ill. $4.00 per year abroad

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TO BE SURE OF UNIFORM COMPOSITION, GREAT STRENGTH AND UNEQUALLED FREE-FLOWING QUALITIES, LOOK FOR THE NAME TOBIN BRONZE IN EVERY ROD . . .

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. . . .

For Arc Welding—Phosphor Bronze, Everdur, Ambrac, Deoxidized Copper.

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from mine to consumer

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WELDING RODS

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The name "Tobin Bronze" is registered in the U. S. Patent Office.

Published monthly by the Welding Engineer Publishing Co. Entered as second class matter Jan. 20, 1916, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

Look how we have improved this goggle

THE original Hardy Welding goggle *improved* — improved by protecting the ventilating slits with louvres which keep the sparks out. This is a real advance in welding goggle design. Perfect ventilation with perfect protection against sparks.

We have improved it still further by adding the new Noviweld lenses which give practically complete protection against infra-red and ultra-violet, and at the same time enable the wearer to see his work clearly. Prices (each) $2.50; (lots of 100) $2.15.

AMERICAN OPTICAL COMPANY

New York, St. Louis, San Francisco, Chicago, Kansas City, Atlanta

Aboard for the Antarctic

Painting by Charles Rosner.

Courtesy of Wide World Studio, New York.

The "Samson", rechristened City of New York, sailed on the Byrd Antarctic Expedition, carrying complete oxy-acetylene welding and cutting equipment for emergency repairs to airplanes, tractors, motors and other mechanical equipment. It comprised Airco Oxygen, Airco Acetylene and Airco-Davis-Bournonville Welding and Cutting Outfits, personally selected by Lieut. Mulroy, Chief Engineer, and Victor Czegka, Master Mechanic, and provided by Air Reduction Sales Company.

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342 MADISON AVENUE, NEW YORK CITY

66 Plants, 110 Distributing Stations and 21 District Offices
Located in Principal Industrial Centers of the United States

In the Brass and Copper Business

—— A NEW TRADEMARK*

This distinctive figure out of the bronze age (illustrative of the chase), is the new mark of the *Chase Brass and Copper Co., Incorporated.*

You are going to see a great deal of it because Chase Brass, Bronze and Manganese Bronze Welding Rod will now carry the new Chase-mark.

It will also appear on all products formerly sold by the *U. T. Hungerford Brass and Copper Company* and the *Waterbury Manufacturing Company,* thus making available a complete line of Brass and Copper supplies under the Chase-mark.

Chase Brass and Copper products are carried in stock by thirteen Chase branches throughout the country,† and are also shipped direct from the factories and mills of the Chase Companies, Inc., of Waterbury, Connecticut. They are known everywhere as *good* products.

Look for the new Chase-mark. See that the Welding Rod and other Brass and Copper supplies you buy are marked "Chase".

CHASE

BRASS WELDING ROD
MANGANESE BRONZE WELDING ROD
BRONZE WELDING ROD

* THIS MARK WAS DRAWN FOR THE CHASE BRASS & COPPER CO., BY FRED G. COOPER

TO BE SPECIFIC . . .

This new Chase-mark will appear on shipping tags and labels and on all boxes, cases and crates in which our brass and copper products are shipped. Wherever practicable, it will also be die-stamped directly on the products. Alpha brass pipe for example, and Chase copper leaders, gutters, Brass, Bronze and Manganese Bronze Welding Rod and other copper, brass and bronze materials will bear this new mark.

† CHASE BRANCHES: New York · Boston · Newark Philadelphia · Baltimore · Cincinnati · Cleveland · Detroit Chicago · St. Louis · New Orleans · Los Angeles · San Francisco.

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For Better Advertising Practice

ABOUT 200 representatives of periodical publishers, principally magazines of general circulation, were present at the Trade Practice Conference of the publishers of periodicals called on October 8th of this year in New York City by the Federal Trade Commission to discuss ways and means of preventing fraudulent advertising. The Hon. W. E. Humphrey, chairman of the Federal Trade Commission, in course of the meeting said in part ". . . The majority of periodical publishers not only obey the law but often go far beyond what the law requires in selecting the advertisements they will publish . . . I do not believe there is an industry in America conducted by more honest, high minded, public spirited men and women than the publishing industry. I do not believe that any industry in America has greater power for good . . . I believe that the future greatness and security of the nation rests to a greater extent on the publishing industry than probably any other." This tribute to the general high standing of publishing should not only inspire confidence in advertised goods but also put publishers on their mettle to maintain the standards of practice which have deserved such a splendid compliment. Fortunately for the advertiser, a sustained advertising campaign of a worthy product is quite generally an economical method of maintaining a satisfactory sales volume.

Published on the 15th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,
608 S. Dearborn St., Chicago, Ill.
Telephone Wabash 7134

G. H. Mackenzie.....President and Treasurer
H. S. Card.....Secretary

H. S. Card.....Editor
H. P. Ritsch.....Associate Editor
A. W. Swift.....Associate Editor

Eastern Office—222 American Circle Bldg., New York. T. E. DePew, Eastern Manager. Telephone, Columbus 6941

Western Office—1244 Harper Ave., Los Angeles, Cal. Miles C. Smith, Western Manager.

Subscription payable in advance and postage free.
United States and possessions and Canada.....$2 a year
Foreign Countries.....$4 a year
Single copy, domestic.....25 cents
Single copy, foreign.....30 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations and of the Associated Business Papers, Inc.

Last Advertising forms close at 8:00 a. m. on the 13th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

Authorized Representatives

CLEVELAND—R. K. Randall, 2094 E. 19th St.
DENVER—A. G. Odell, Public Opportunity School.
GREAT BRITAIN—Capt. D. Richardson, 26 Winterbrook Road, Herne Hill, London.
AUSTRALIA AND NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand.
SOUTH AFRICA—J. W. Arnison, 35a Victoria Ave., Benoni, Transvaal, South Africa.

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
Prest-O-Lite Co.

ACETYLENE CYLINDERS
Keith Dunham Company
Pressed Steel Tank Co.

AIR LIQUEFACTION OXYGEN PRODUCING PLANTS
Keith Dunham Company
Heylandt Sales Co.

ALUMINO-THERMIC WELDING
Metal & Thermit Corporation

ALUMINUM SOLDER
Crown Aluminum Solder Co.
Miller Aluminum Solder Co.
Weldene Corporation

ANNEALING FURNACES
General Electric Co.
Westinghouse Elec. & Mfg. Co.

APRONS (Asbestos)
Ideal Face Shield Co.

ASBESTOS INSULATED WIRE AND CABLE
Central Steel & Wire Co.

BLOW PIPES
See "Torches."

BOOKS
The Welding Engineer Pub. Co.
Electric Arc Cutting & Welding Co.

BRAZING OUTFITS
Air Reduction Sales Co.
American Oxygen Service Co.
Bastian-Blessing Co.
Buckeye Oxygen Co.
Craftsweld Equipment Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Alexander Milburn Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.
Williams & Co.

BRONZE FILLER RODS
American Brass Co.
Central Steel & Wire Co.
Chase Brass and Copper Co., Inc.
Krembs & Co.
Mueller Brass Co.
Steel Sales Corp.

BUFFERS
Biax Flexible Shaft Co.
R. G. Haskins Co.
N. A. Strand & Co.

BUTT WELDERS
See "Electric Resistance Welders"

CABLE (Arc Welding)
Allan Mfg. & Welding Co.
Central Steel & Wire Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Lincoln Electric Co.
Quasi-Arc Weldtrode Co.
Una Welding and Bonding Co.
U. S. L. Battery Corp.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CARBIDE
Air Reduction Sales Co.
National Carbide Co.
Shawinigan Products Corp.
Union Carbide Sales Co.

CARBON (Blocks, Paste, Electrodes, etc.)
Air Reduction Sales Co.
Central Steel & Wire Co.
Electric Arc Cutting & Welding Co.
National Carbon Co.
Oxweld Acetylene Co.

CARBON BURNING EQUIPMENT
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.

CAST IRON SOLDER
Crown Aluminum Solder Co.
Weldene Corporation

CAUSTIC POTASH
Innis, Speiden & Company

CONSULTING ENGINEER
E. F. Hollinger
R. E. Kinkead
R. C. Pierce

CONTRACT WELDERS
S. O. S. Welding Corp.

CUTTING ELECTRODES (Electric Arc)
Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Lincoln Electric Co.
National Carbon Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CYLINDERS (Acetylene)
Keith Dunham Company
Pressed Steel Tank Co.

CYLINDERS (Oxygen, Hydrogen)
Chas. L. Gulick.
Wm. Wharton, Jr. Co.
Harrisburg Pipe & Pipe Bending Co.

DRILLS, PORTABLE ELECTRIC
Biax Flexible Shaft Co.
R. G. Haskins Co.
Stoody Company
N. A. Strand & Co.

ELECTRIC ARC WELDING OUTFITS
Allan Mfg. & Welding Co.
Burke Electric Co.
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
Fusion Welding Corporation
General Electric Co.
Goodman Electric Machinery Co.
Gibb Welding Machines Co.
Hobart Brothers
C. H. Hollup Corp.
Lincoln Electric Co.
E. A. Lundy Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Incorporated
Stoody Co.
Una Welding and Bonding Co.
Welding Service Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRIC RESISTANCE WELDERS
Federal Machine & Welder Co.
General Electric Co.
Gibb Welding Machines Co.
Goodman Electric Machinery Co.
R. D. Thomas Co.
Welding Appliance Co.

ELECTRODES (Carbon Arc Welding)
See "Cutting Electrodes"

ELECTRODES (Metallic Arc Welding)
American Steel Engineering Co.
American Steel & Wire Co.
Atlas Foundry Co.
Central Steel & Wire Co.
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Fusion Welding Corporation
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corporation
Koro Corporation
Lincoln Electric Co.
Page Steel & Wire Co.
Quasi-Arc Incorporated
Reid-Avery Co.
Roebling, John A., Sons Co.
Seneca Wire Mfg. Co.
Standard Steel & Wire Co.
Steel Sales Corp.
Stoody Company
Una Welding and Bonding Co.
Welding Service Co.
Wickwire Spencer Steel Corp.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE HOLDERS
Allan Mfg. & Welding Co.
Burke Electric Co.
Chicago Steel & Wire Co.
Electric Welding Machine Co.
Fibre-Metal Products Co.
Fusion Welding Corporation
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Koro Corporation.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Stoody Co.
Waters Arc Welding Corporation
Welding Service Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE TIPS (Resistance Welding)
Elkon, Inc.

ELECTROLYTIC OXYGEN AND HYDROGEN GENERATING EQUIPMENT
International Oxygen Co.

FACE SHIELDS (Arc Welding)
Allan Mfg. Co. & Welding Co.
American Optical Co.
Burke Electric Co.
Central Steel & Wire Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Incorporated
Stoody Company
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.
Willson Goggles, Inc.

FILLER RODS
Air Reduction Sales Co.
American Brass Co.
American Steel Engineering Co.
American Steel & Wire Co.
Atlas Foundry Co.
Central Steel & Wire Co.
Craftsweld Equipment Co.
Fusion Welding Corporation
C. H. Hollup Corp.
Imperial Brass Mfg. Co.
Krembs & Co.
Mueller Brass Co.
Koro Corporation
Oxweld Acetylene Co.
Page Steel & Wire Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Seneca Wire Mfg. Co.
St. Paul Welding & Mfg. Co.
Standard Steel & Wire Co.
Steel Sales Corp.
Stoody Co.
Stulz-Sickles Co.
Torchweld Equipment Co.
Welding Service Co.
Wickwire Spencer Steel Corp.
Weldit Acetylene Co.
Williams & Co.

FIREPROOF PLASTIC MATERIAL
Air Reduction Sales Co.
Joseph Dixon Crucible Co.
National Carbon Co.

FLUE WELDERS (Electric)
General Electric Co.

FLUXES
Air Reduction Sales Co.
Anti-Borax Compound Co.
Metal & Thermit Corp.
Central Steel & Wire Co.
Gold Seal Mfg. Co.
Krembs & Co.
Modern Engineering Co.
Momac Sales Co.
Oxweld Acetylene Co.
St. Paul Welding & Mfg. Co.
Simplex Flux and Solder Co.
Torchweld Equipment Co.
Weldene Corporation
Weldit Acetylene Co.

GAS SAVING DEVICES
Harris-Calorific Co.
Weldit Acetylene Co.

Remarkable Adaptability to VARIOUS *kinds of Welding Work*

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Austin-Hastings Co., Inc.
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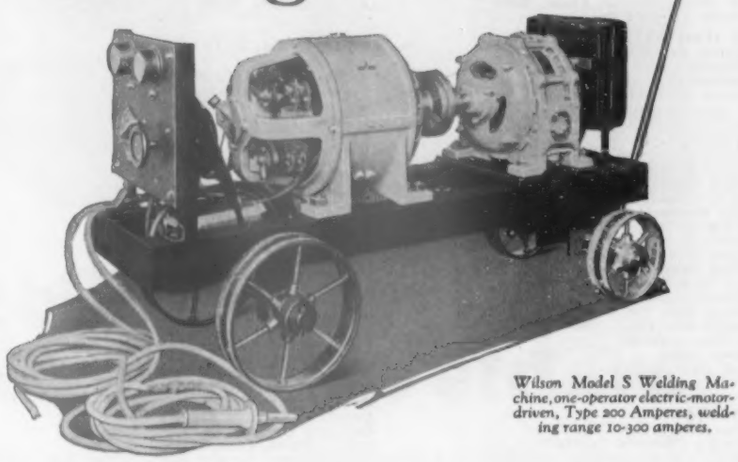
E. 53rd St. & Lakeside Ave., Cleveland, O.
1600 E. Euclid Ave., Detroit, Mich.
Station N, Box 36, Cincinnati, Ohio
Lock Box U, Chicago, Illinois
2208 North 2nd St., St. Louis, Mo.
505 Esperson Bldg., Houston, Texas
3323 Throckmorton Ave., Dallas, Texas
1103 Plymouth Bldg., Minneapolis, Minn.
Room 609, Ideal Bldg., 17th & Champa Sts., Denver, Colorado
830 Commercial Trust Bldg., Philadelphia, Pa.
410 Atlas Life Bldg., Tulsa, Okla.
Smith-Booth-Usher Co.
50 Fremont St., San Francisco, Calif.
228 Central Ave., Los Angeles, Calif.
Oliver H. Van Horn Co., Inc.
522 Camp St., New Orleans, La.

Welding Wire

Austin-Hastings Co., Inc.
226 Binney Street, Kendall Square, Cambridge "C", Boston, Mass.
J. G. Christopher Co.
422 E. Bay Street, Jacksonville, Fla.
Peter A. Frasse & Co., Inc.
Grand & Sullivan Streets, N. Y. C.
50-52 Exchange Street, Buffalo, N. Y.
135 Walnut Street, Hartford, Conn.
Wissahickon & Hunting Park Aves., Philadelphia, Pa.
General Engineering Co.
Box 481, Casper, Wyo.
North Coast Electric Co.
206 3rd Ave., South, Seattle, Wash.
703 Pacific Ave., Tacoma, Wash.
329 Everett St., Portland, Oregon
Geo. A. Post Co., Inc.
(Steam Railroads)
136 Liberty St., N. Y. C.
Steel Sales Corporation
129 S. Jefferson St., Chicago, Ill.
Sligo Iron Store Co.
1301 N. 6th St., St. Louis, Mo.
Chas. A. Strelinger Co.
149 E. Larned St., Detroit, Mich.
Smith-Booth-Usher Co.
50 Fremont St., San Francisco, Calif.
228 Central Ave., Los Angeles, Calif.
Oliver H. Van Horn Co., Inc.
522 Camp St., New Orleans, La.
Franklin Ave. & Austin St., Houston, Texas
Williams & Company, Inc.
901 Pennsylvania Ave., Pittsburgh, Pa.
Welded Products Company
2701 7th Ave., No., Birmingham, Ala.
Welding Engineering Co.
Johnstone Bldg., Bartlesville, Okla.

Foreign Machines and Wire

American Trading Company
(Japan and dependencies)
96 Wall Street, New York City
Amsterdamsch Kantoor voor Indische Zaken
(Dutch East Indies)
Mr. B. G. D. Ter Braake, 85 St. Marks Avenue, Brooklyn, N. Y.
Baldwin Locomotive Works
(South America, [excepting Columbia, Venezuela and British Guiana], West Indies, [excepting Cuba], Continental Europe, Northern Manchuria)
Philadelphia, Pa.
International Railway Supply Co.
(Columbia, Venezuela, British Guiana, Central America, Cuba, Mexico, China, Philippine Islands)
30 Church Street, New York City
G. D. Peters & Company, Ltd.
(Great Britain, Ireland, South Africa, India, Australia, New Zealand, Denmark, Spain, Portugal)
Caxton House, Westminster, London, S. W. 1, England
1001 New Birks Bldg., Montreal, Canada



Wilson Model S Welding Machine, one-operator electric-motor-driven, Type 200 Amperes, welding range 10-300 amperes.

A WELDING range of 10-300 amperes, rugged construction, perfect commutation, narrow frame and unusual portability give this Wilson Type 200 Amperes Model S Welder remarkable adaptability to various kinds of welding work.

Here is a machine that is adapted to a heavy current and large diameter electrodes for *rapid depositing* of metal, AND ALSO to a short arc with exceedingly close regulation of welding current for *strength welding* and repair work. Close control and quick recovery make the machine ideal for overhead welding, and it welds the thinnest sheet metal the electric arc can handle. It is equipped to give full welding range without extra apparatus or extra cost.

Other Wilson Model S Machines include one-arc gasoline-engine-driven, belt-driven or motor-driven units, and a two-arc motor-driven unit, with capacities of 10-250, 10-300, 10-600, 15-500, 15-1000 amperes. Write today for bulletins which illustrate and describe all the Model S Wilson Arc Welding Machines.

Use Wilson "Color-tipt" Welding Wire

For steel, cast iron, malleable iron, brass, bronze, copper, aluminum, Monel Metal. There is just the *right* grade (analysis) for each kind of metal—for the metal *you* are welding—and every grade runs *uniform throughout.* Send for samples—just indicate the kind of metal you wish to weld.

WILSON WELDER & METALS CO. INC., 20 WILSON BUILDING, HOBOKEN, N. J.

WILSON

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GLOVES (Asbestos)
Ideal Face Shield Co.

GAUGES
Moto Meter Co.
National Gauge & Equipment Co.

GENERATORS (Acetylene)
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Harris Calorific Co.
M. Keith Dunham
Imperial Brass Mfg. Co.
Milburn, Alexander Co.
Modern Engineering Co.
Oxweld Acetylene Co.

GLOVES
Morrison-Ricker Mfg. Co.

GOGGLES
American Optical Co.
Chicago Eye Shield Co.
Ideal Face Shield Co.
Willson Goggles, Inc.

GRAPHITE (Rods, Blocks, Paste, Etc.)
Joseph Dixon Crucible Co.

GRINDERS (Portable Electric)
Biax Flexible Shaft Co.
R. G. Haskins Co.
Stoody Company.
N. A. Strand & Co.

HELMETS (Arc Welding)
Allan Mfg. & Welding Co.
American Optical Co.
Burke Electric Co.
Central Steel & Wire Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
Fusion Welding Corporation
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Incorporated
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.
Willson Goggles, Inc.

HOSE COUPLINGS
Carl A. Norgren Co.
See also under "Needle Valves"

HYDROGEN
Gas Products Association
International Oxygen Co.

HYDROGEN GENERATING PLANTS
International Oxygen Co.

LEAD WELDING UNITS
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Modern Engineering Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.
Weldit Acetylene Co.

LIGHTERS (For Gas Torches)
Air Reduction Sales Co.
Bastian-Blessing Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Matchless Utilities Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Safety Gas Lighter Co.
Shoot-a-Lite Corporation.
Torchweld Equipment Co.

MANIFOLDS
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co
Victor Oxy-Acetylene Equipment Co.

MECHANICALLY OPERATED CUTTING AND WELDING TORCHES
Air Reduction Sales Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

MOLDING MATERIAL
See "Fire Proof Plastic Material"

MONEL METAL RODS AND ELECTRODE
Central Steel & Wire Co.
Wilson Welder & Metals Co.

NEEDLE VALVES
Air Reduction Sales Co.
Bastian-Blessing Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co
Victor Oxy-Acetylene Equipment Co.

NICHROME WELDING WIRE
Driver-Harris Co.

NITROGEN
Air Reduction Sales Co.
Gas Products Association
Linde Air Products Co.
International Oxygen Co.

OXYGEN
Air Reduction Sales Co.
American Oxygen Service Co.
Buckeye Oxygen Co.
Gas Products Association
International Oxygen Co
Linde Air Products Co.

OXYGEN PRODUCTION PLANTS
Keith Dunham Company
Heylandt Sales Co.

PORTABLE ARC WELDING OUTFITS (Mounted on Trucks)
General Electric Company
Shrader Electric Company

PREHEATING DEVICES AND OVENS
Imperial Brass Mfg. Co.
Metal & Thermit Corp.
St. Paul Welding & Mfg. Co.

RAIL BONDS
Una Welding and Bonding Co.

RAIL JOINT WELDERS
Una Welding and Bonding Co.

REAMERS (Portable Electric)
R. G. Haskins Co.
N. A. Strand & Co.

REGULATORS
Air Reduction Sales Co.
Bastian-Blessing Co.
American Oxygen Service Co.
Buckeye Oxygen Co.
Craftsweld Equipment Co.
Fusion Welding Corporation
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
St. Paul Welding & Mfg. Co.
Stoody Company
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.
Weldit Acetylene Co.
Williams & Co.

SCHOOLS
Illinois Welding Works.

SEAM WELDERS
See "Electric Resistance Welders"

SILVER SOLDER
Handy & Harman

SWEDISH IRON WELDING WIRE
Bissett Steel Co.

SPOT WELDERS
See "Electric Resistance Welders"

TANK CONNECTIONS
Air Reduction Sales Co.
Bastian-Blessing Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

THERMIT WELDING
Metal & Thermit Corp.

TORCHES (Welding and Cutting)
Air Reduction Sales Co.
American Oxygen Service Co.
Buckeye Oxygen Co.
Craftsweld Equipment Co.
Bastian-Blessing Co.
Fusion Welding Corporation
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
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Special Materials For Aircraft Welders

ALL Swedox warehouses are carrying complete stocks of specially selected wires for airplane welding for both production and repair. Those who are building and repairing airplane structures should consult us on the selection of the proper materials and the proper sizes to use.

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Every Manufacturer Should Ask Himself These Questions

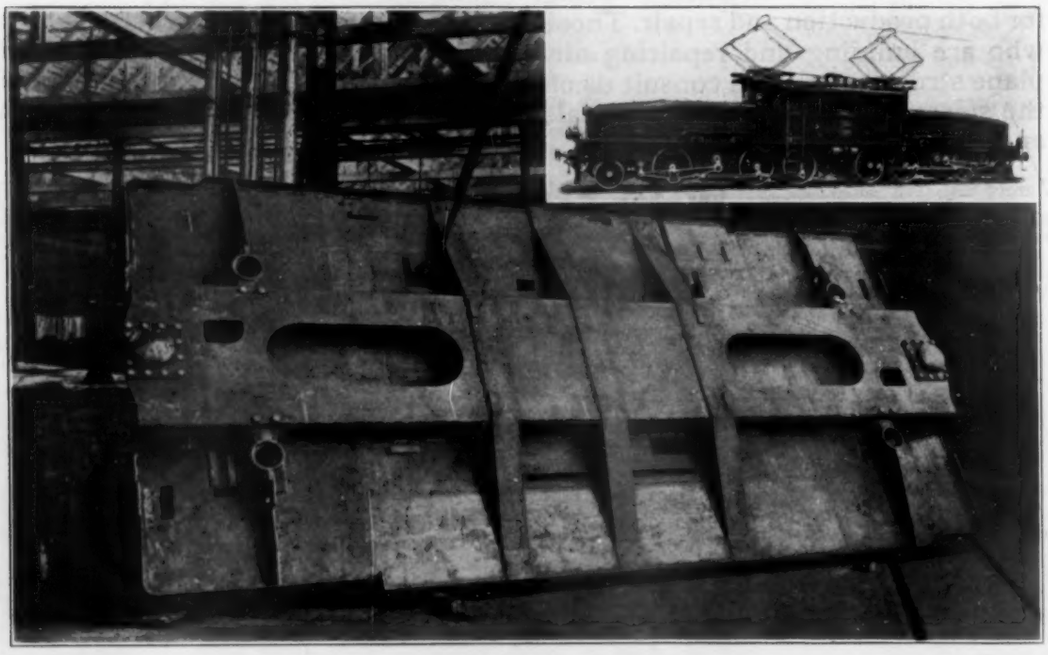
"WHAT is the best policy on which to base my future welding operations? Is the trend in welding toward progress and improvement; is there a demand for higher quality? Or do present methods and materials meet all requirements?"

All these questions can be answered by choosing between "low-priced" welding wire which eats up expensive labor, requires excessive current, produces an unreliable, hit-or-miss weld and restricts welding to a limited scope,—and high-priced QUASI-ARC Electrodes which save 50% or more labor, require one-third less current and produce an absolutely reliable weld of uniform high quality.

It is an axiom in industry that the more you weld the more you save. The scope of your welding operations depends on the adaptability of your welding material. QUASI-ARC opens an unlimited field for welding because anything that can be riveted can be Quasi-Arc welded with greater all-around efficiency and economy.

A practical demonstration of the QUASI-ARC Process in your own shop will enable you to judge its merits for yourself. No obligation, of course. Why not write us?

Quasi-Arc



145 TON ELECTRIC LOCOMOTIVE

Center underframe carrying transformers, pumps, switch gear, etc., totalling 30 tons, completely QUASI-ARC welded. This new method of constructing underframes was selected by the Swiss Federal Railways 1924-1925, specifying highest quality covered rods, and proved to be a saving in weight and production cost. A series of 18 locomotives of this type have been in service since.

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Sole Manufacturers of Quasi-Arc Electrodes and Welding Equipments and Consultants in Reference to their Application

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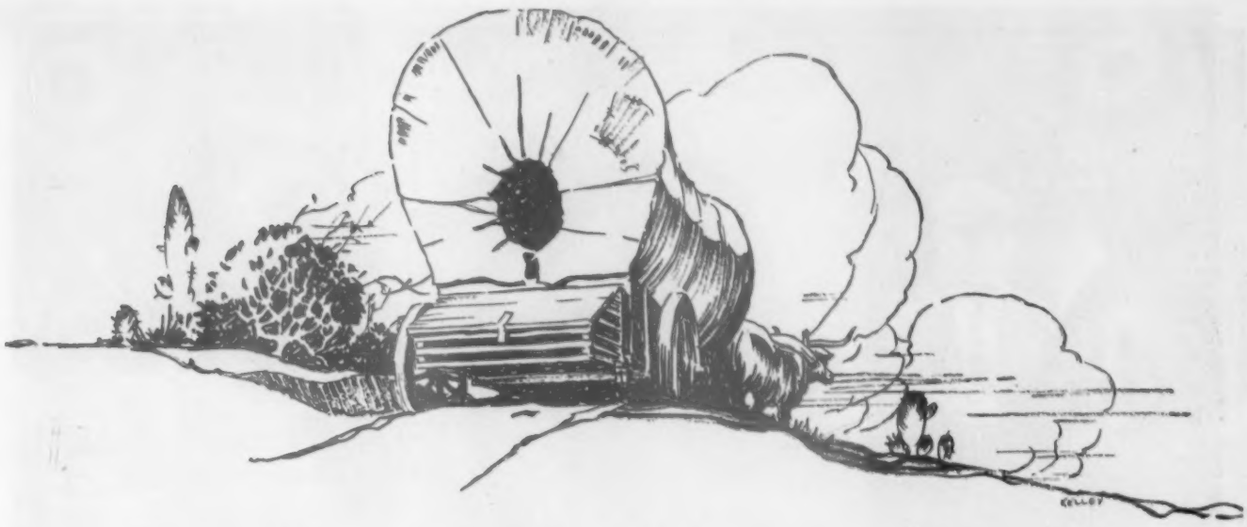
For Complete Details See McGraw-Hill 1928 Electrical Engineering Catalog.



Pioneering courage

WHEN an industry has become great, one is likely to forget that in the beginning the odds were overwhelmingly against it and that its very life depended on one thing—the courage of the men behind it.

So it is with Union Carbide. The dramatic accident of the discovery of calcium carbide, by men who later founded the Union Carbide Company, fired their imaginations with its great industrial possibilities.

Difficulties must have seemed insuperable. Yet in the face of these odds a process that would yield uniform and high quality product was developed, new uses for carbide and its child acetylene were discovered and equipment that would make these uses practical was invented.

Today, the great welding and cutting industry with its innumerable applications, the thousands of farms lighted with acetylene and the cheap and efficient mine and marine lighting systems, are a few of the things that stand as monuments to the pioneer courage that made them possible.

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UCC
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"Who is *that* man?"

"He looks sort of familiar. Does he belong here?" asked the superintendent.

"He isn't on our payroll," replied the master mechanic, "but he sure gives us a lot of help with our welding. He's the Linde Service Supervisor. When we run into a tough job—like that new high pressure steam line, he's the man that shows us how to do it. Knows his business and ours where welding is concerned."

IF your job involves more than ordinary welding technique, the Linde Service Supervisor is at your call. He is part of Linde Process Service which is free to Linde customers.

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"A product of Union Carbide"

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Just what you need

PREST-O-WELD blowpipes for oxy-acetylene welding and cutting have a way of paying for themselves almost before you fully realize their usefulness.

Any good mechanic can operate Prest-O-Weld. Sturdy in service, and backed by our own prestige as the leading manufacturers of oxy-acetylene apparatus, Prest-O-Weld is just what you need.

Reasonably priced, and sold by jobbers everywhere.

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PREST-O-WELD

Lad does some campaigning

"Here, Lad . . .

I've just been taking a straw vote around here to see whether arc welding will better our net income, which is away off this year.

It may be interesting for you to learn that you are the only one that brought up the fact that one make of machine would give us better NET results than any other make."

"Fine, Pop . . .

a straw vote is simply to show how people are thinking.

And did you ever see the majority think any other way than in a circle?

Arc welding from one machine is better for our NET than arc welding from a different make.

Here's an actual case (particulars on request).

A Lincoln 'Stable-Arc' welder produced 1,056 feet of welded plate work.

Alongside of it another make of machine, under identical conditions of time and work, welded 890 feet of the job.

You don't need an adding machine to tell you that one machine is better for our net than the other.

And you'd better get that Lincoln machine because what we need more than a straw vote right now is a HAYMAKER."

Only "Stable-Arc" Welders have all these features

Variable Voltage.
Laminated Magnetic Circuit.
Separately-excited Generator Field.
Double Control of Welding Heat.
Steady Arc Throughout Entire Welding Range.
All Steel Construction.
Full Capacity for either Metallic or Carbon Arc Welding.

These features make welding easier. Results—better welds and greater output.
Ask any Operator!

The Lincoln Electric Co., Dept. No.27-10, Cleveland, Ohio

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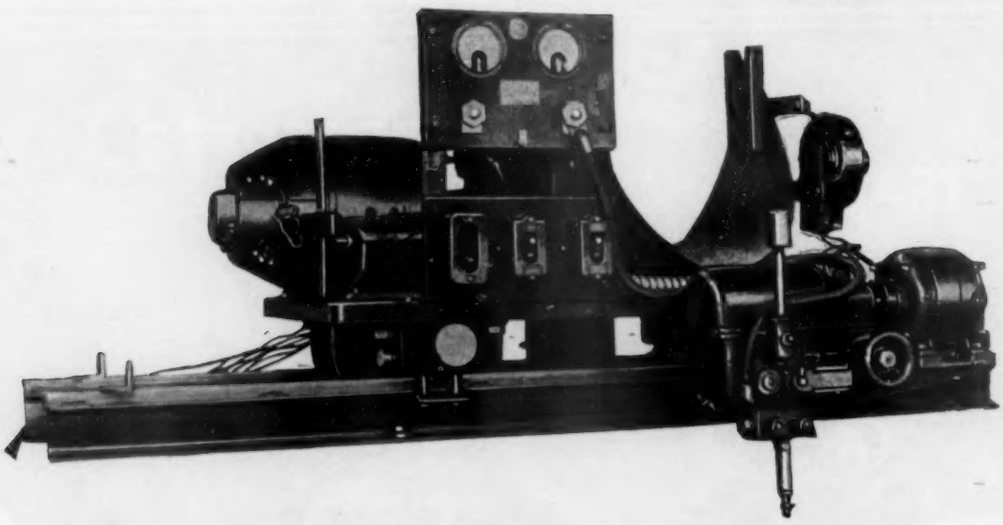
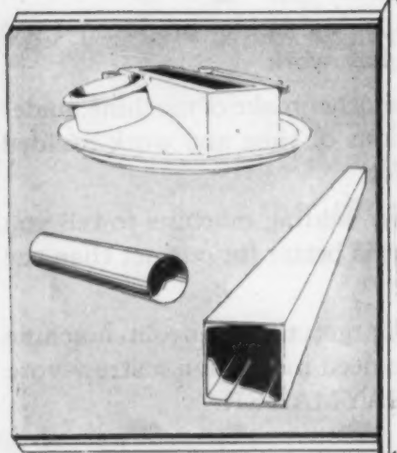
LINCOLN "Stable-Arc" WELDER



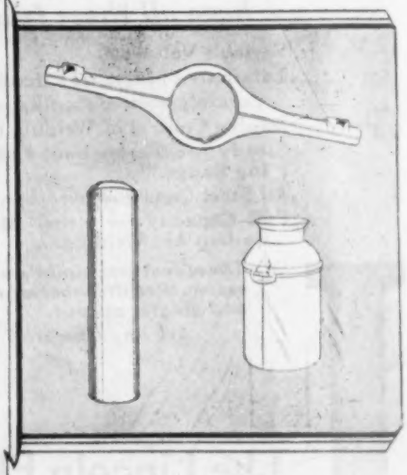
G-E AUTOMATIC ARC WELDERS

Industry's NEW Production Tool



Boilers, tanks, and pipes, building columns and roof trusses, ice-cream and milk cans, metal railroad ties, rear axle housings, and hundreds of other metal products with straight or circular seams are being fabricated with G-E automatic arc welders.

General Electric developed the first automatic arc welder, made the first successful application of it, and is, to-day, the world's largest manufacturer of this type of equipment. Ask your nearest G-E office for descriptive literature, advice, and assistance.



THE MORE YOU ARC WELD THE MORE YOU SAVE

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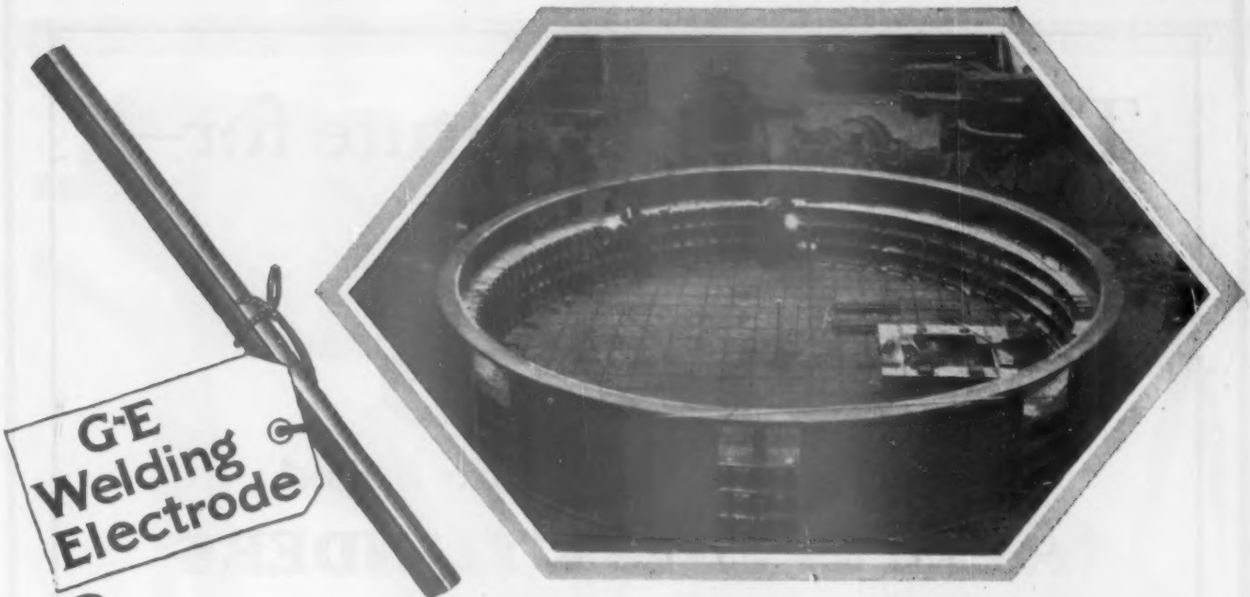
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES



for unfailing service

This giant generator frame is a part of the Conowingo water-power development. It will be subjected to severe, continuous, and long operation. Arc welding has prepared it for unfailing service—arc welding and G-E welding electrode.

More and more, fabricators of iron and steel are turning to arc welding. This new, improved method of construction necessitates electrodes which assure sound, tough unions. You need not worry about welds of uncertain quality when any of these tried and tested G-E welding electrodes are employed:

Type "F" is used for the general welding of steel.
Type "B" is best for automatic welding.
Type "A" is recommended for cast iron.

Special distributors for G-E welding electrodes, located throughout the country, are equipped to give you prompt service. Get in touch with the G-E Welding Electrode Distributor near you or write to the Merchandise Department, General Electric Company, Bridgeport, Connecticut.

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MERCHANDISE DEPARTMENT. BRIDGEPORT. CONNECTICUT

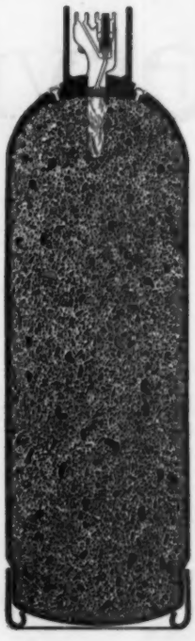
There is no substitute for—

Safety

OXECO

Seamless, Monolithic Filled

ACETYLENE CYLINDERS



Mr. Acetylene Consumer:

Have you inquired into the safety of the cylinders you are using?

Do you know that many responsible acetylene producers pay a premium for Oxeco Seamless Monolithic Filled Acetylene Cylinders in order to supply you acetylene in cylinders that are always 100% safe?

The one piece construction of the Oxeco Seamless Shell prevents its fragmentation under any circumstances.

Monolithic filler never deteriorates.

There are thousands of Oxeco seamless cylinders in daily use and not one of them has ever endangered human life or damaged surrounding property.

We are not manufacturers of acetylene. We are manufacturers of acetylene cylinders.

Booklet upon Request

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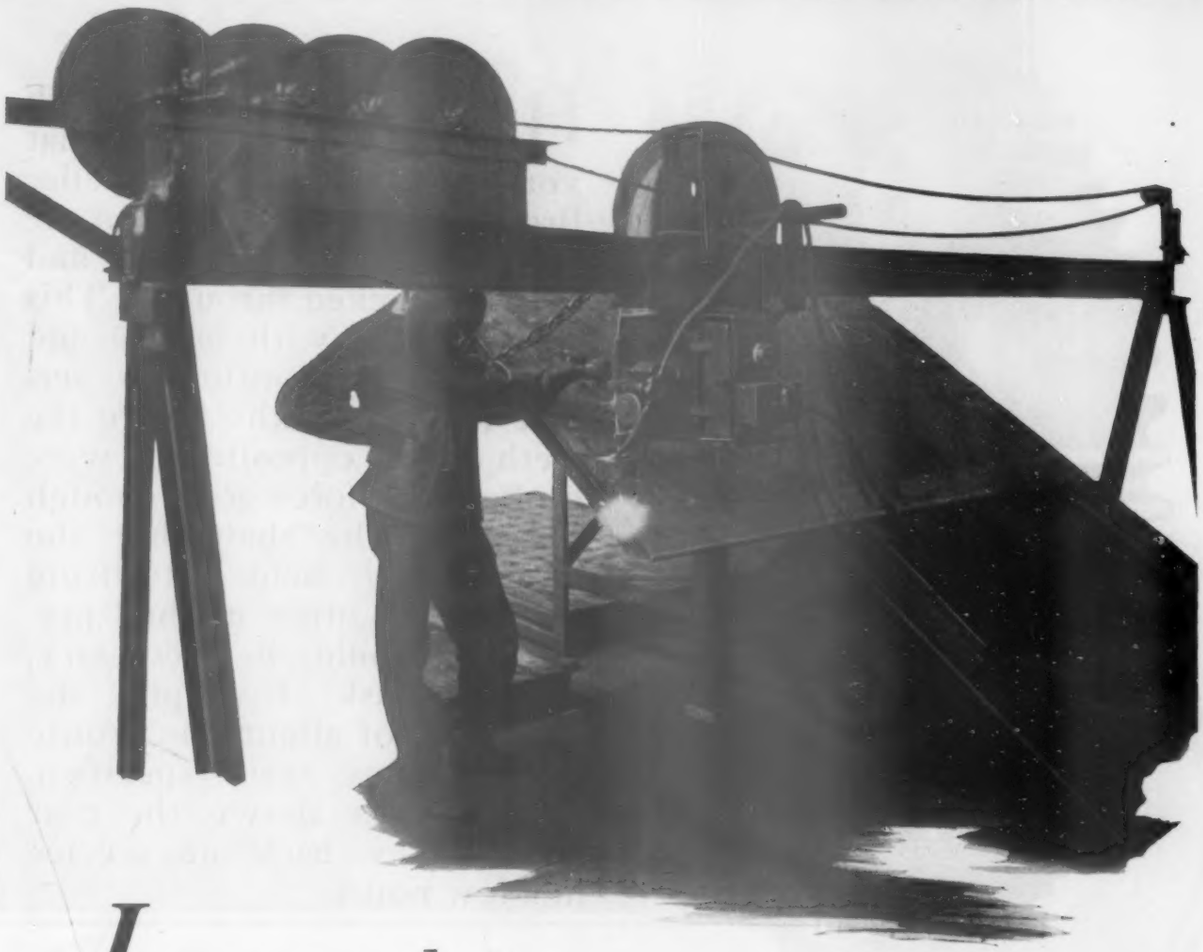


Increased production with "KORO"

(Patent applied for)

AUTOMATIC ARC WELDING WIRE

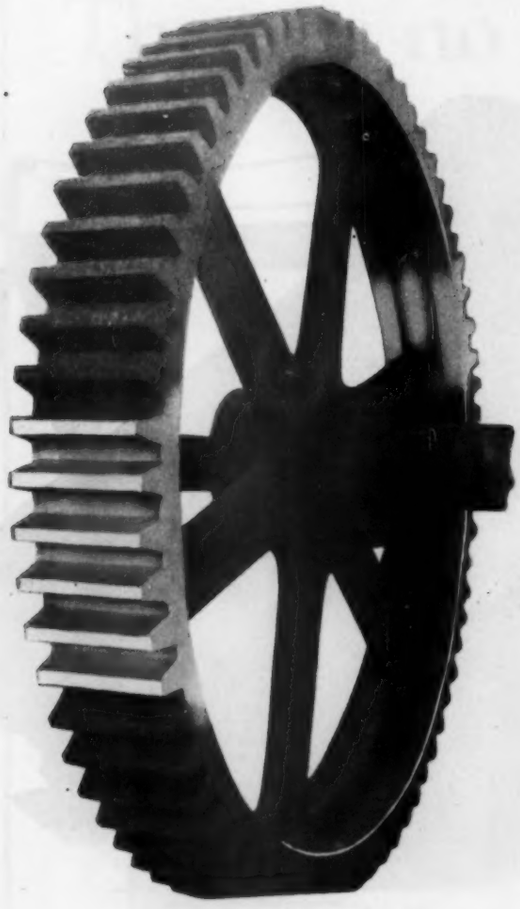
SEVENTY-TWO feet of satisfactorily welded seam per hour on ¼" boiler plate, using from 390 to 420 amperes, is the average rate of the welder shown above. The photograph was taken in the plant of a large boiler manufacturer who fabricates his boilers exclusively by the arc welding process. KORO High Speed Automatic Arc Welding Wire is being used exclusively on the automatic equipment. Production is about five times that obtained by hand welding.

The distinctive KORO knurling feature enables us to incorporate in the rod the correct amount of flux and still have perfect electrical contact. Our customers report greater speed, better penetration, and a higher quality of deposit. Users and prospective users of automatic arc welding equipment should investigate the merits of this new KORO development in welding wire.

KORO CORPORATION
WAUKEGAN, ILLINOIS

KORO Processed Electrodes Have the Distinctive Appearance Shown Below

Bronze Welding Will Do This For You



HERE is a repair job which demonstrates exactly what you can expect of a Mueller Bronze Weld. The teeth on the far side were broken out and the rim cracked through. This was replaced with bronze and had been in continuous service for 18 months before the teeth on the opposite side were broken by a force great enough to spring the shaft, but the bronze teeth held. Realizing that by any other method preheating would be necessary, with the risk of warping the wheel out of alignment, bronze welding was again specified. The result is shown, the gear good as new, back into service in a few hours.

MUELLER Welding Bronze Rod is all that good welding rod should be —makes sound welds which are tough, strong and non-porous.

Mueller Welding Bronze fuses quickly, melts at low temperature and flows evenly and freely. Absence of porosity eliminates sputtering and explosions. Make sure of the quality of your work — use Mueller Welding Bronze Rod. Let us send you your free sample. Write us today.

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PORT HURON MICHIGAN
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THREE GENERATIONS OF BRASS MAKING

The Court of Last Resort

THAT Natweld Gauges meet every requirement of the Underwriters' Laboratories, and are approved by them, is self-evident.

That Natweld Gauges are made by an organization rich in many years' experience of gauge manufacturing, is also a truism.

But Natweld Gauges have a greater claim on your appreciation. They have been accorded a verdict of unanimous satisfaction at the court of last resort—the user.

No better proof of this widespread acclaim need be mentioned than the fact of world-wide demand. This demand has become so great that volume production has enabled us to make prices for this *better* line of gauges that are surprisingly low.

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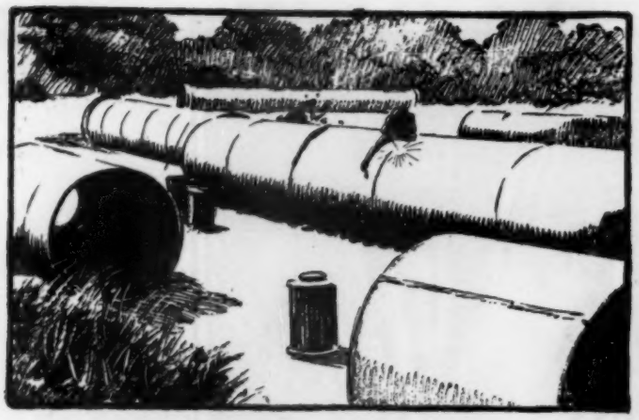
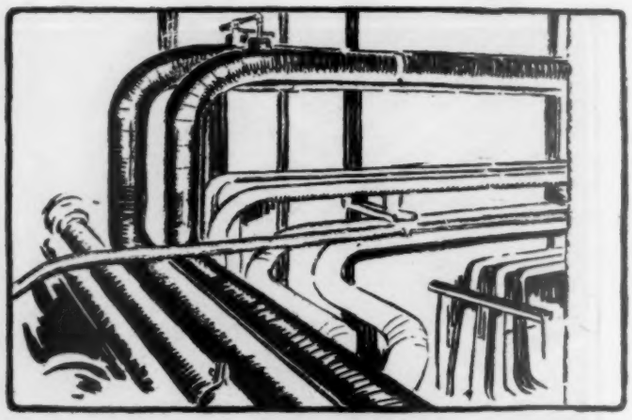


Operators, supervisors, and engineers on a pipe line job, who are continually facing new problems of welding procedure, need a source of information that can go right into the field with them, always ready with the answer as quickly as the questions arise. In no place more than in the oil and gas fields is The Welding Encyclopedia appreciated and relied upon by the men on the job. One reason is that it is not a book of theory alone, but of practical information which is obtained from actual experience.



The growing popularity of welding in the installing of industrial pipe systems for steam, water, oil, or gases, obligates both the piping contractor and the plant engineer to become thoroughly acquainted with the best welding practice in this class of work. The welded line insures the utmost in operating efficiency, providing the welding is properly done. As a reference volume for pipe welding facts and data, the Welding Encyclopedia is complete, reliable, and up-to-date.

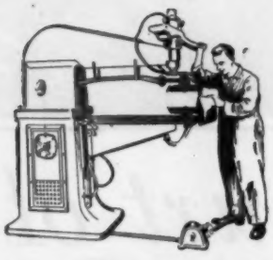
Valuable New Features in
The Welding Encyclopedia
New Sixth Edition

Electric Arc Welding

Recent improvements in both manually operated and automatic arc welding equipment, new electrode materials, and the development of new processes, all challenge your knowledge of what is the latest and best in arc welding procedure for your particular job. The latest and best is always to be found in the Welding Encyclopedia, which also contains design data for welding of building structures or of machine bases and frames.

Oxy-Acetylene Welding

Within the last two years there have been many developments in the application of this process. The growing use of stainless steels, for example, has called for a special technique which has successfully welded metals formerly not considered weldable. Bronze welding, hard-facing of cutting edges and grinding surfaces, have also seen important improvements and new applications. All of these developments are fully covered in the Sixth Edition.

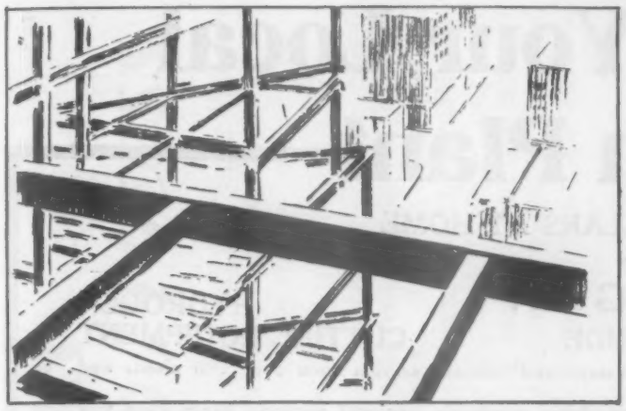


Resistance Welding

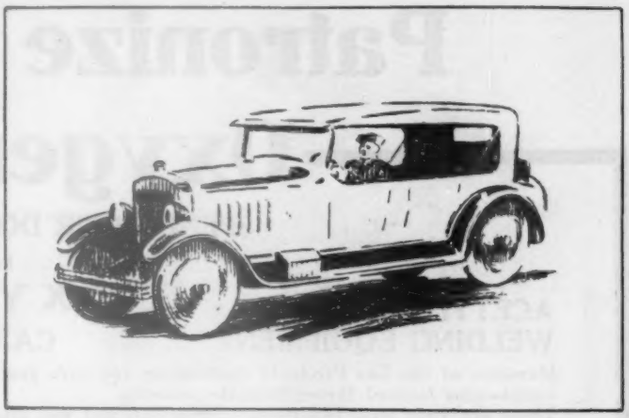
Important progress in this field has been made in the design of a great number of automatic welders for specific jobs, effecting enormous savings of time. Of importance, also, to present users of resistance welding are the new electrode metals and the methods of facing electrodes to prolong their life and to facilitate the welding of certain metals. For the fundamentals of spot, butt, and seam welding, and for the design of the variety of joints possible by this process, read The Welding Encyclopedia, Sixth Edition.

Thermit Welding

Since repair work that calls for Thermit welding is usually a large job, recent improvements in the process which have effected a considerable saving in both time and material in the making of the molds and in the welding, are of great importance to steel mills, ship yards, and other users of heavy machinery. The chapter on Thermit welding was prepared expressly for The Welding Encyclopedia, Sixth Edition.



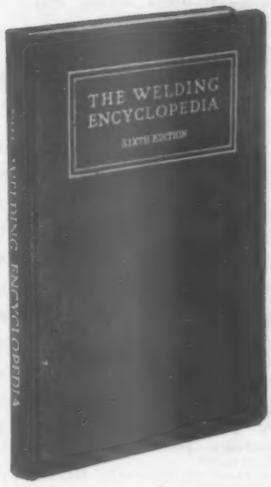
Numerous all-welded residences, factories and bridges have proved the practicality of structural welding, but few architects or engineers are yet equipped with all of the information necessary to insure both safe and economical welded construction. Do you know, for example, the amount of weld metal required to replace a rivet of a certain size? Or the design of a joint which gives to the fullest extent all of the advantages offered by welding? These and scores of other fundamental questions The Welding Encyclopedia will answer for you.



There are always opportunities to reduce costs and to improve the product if those in charge of welding are thoroughly acquainted with the latest refinements of the processes. The automobile industry has achieved remarkable economies by following this principle, and is one of the many sources of the wealth of new welding information brought together in this one volume. Thousands of copies of the Encyclopedia are now in use by production engineers who want to be informed on the most efficient welding procedure.

The Welding Encyclopedia is the only book that covers completely all branches of the art of welding.

The editorial office of The Welding Engineer is recognized as the headquarters for authoritative information and help on all branches of welding, and conducts a large volume of correspondence helping welders and welding departments out of their difficulties. In a period of eight months it was found that 95% of the problems submitted to this office were answered directly from the pages of The Welding Encyclopedia.



It tells how to weld every weldable metal by each of the welding processes. ¶ It gives detailed instructions for handling the important welding jobs, such as boiler welding, sheet metal welding, tank welding, pipe welding, etc. ¶ It tells how to prepare parts for welding. ¶ It tells how to install and care for welding equipment. ¶ It explains the meaning of all words and terms found in welding literature. ¶ It tells where to buy all standard makes of welding apparatus and supplies.

496 Pages — 645 Illustrations

Price $5.00

The table of contents below can give you only a very general idea of the scope of this work. Send for the book and give it a careful examination. We guarantee that it will be fully satisfactory and if not we will cheerfully make a refund.

Contents

1. Illustrated encyclopedia covering all words, terms and trade names used in welding.
2. Oxy-Acetylene Welding.—Aluminum, Steel, Cast Iron, Brass Bronze. (Full instructions for welding each of these metals.)
3. Electric Arc Welding.—Complete instructions for welding all metals, studding, cutting, etc.
4. Electric Resistance Welding.—Includes Butt Welding, Line Welding, Percussion Welding and Spot Welding.
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8. Complete chapters on Pipe Welding, Rail Joint Welding and Tank Welding, explaining procedure in detail.
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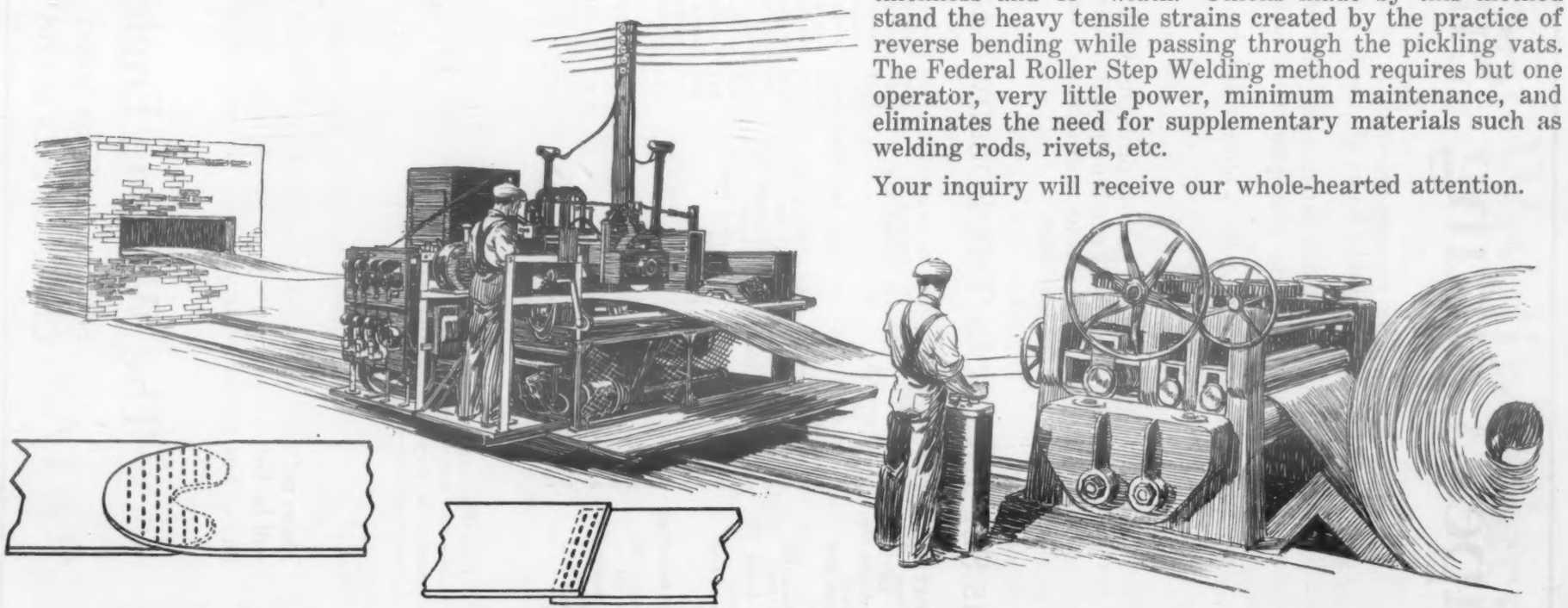

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4" Lateral
4" Round End
4" Tee
4" Y
4" Split Bull Plug

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6" Rt. Angle Ell
6" Lateral
6" Round End
6" Tee
6" Y
6" Split Bull Plug

8" 3 Piece Ell
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8" Rt. Angle Ell
8" Lateral
8" Round End
8" Tee
8" Y
8" Split Bull Plug

10" 3 Piece Ell
10" 45° Ell
10" Rt. Angle Ell
10" Lateral
10" Round End
10" Tee
10" Y
10" Split Bull Plug

12" 3 Piece Ell
12" 45° Ell
12" Rt. Angle Ell
12" Lateral
12" Round End
12" Tee
12" Y
12" Split Bull Plug

4x3 Tee
6x3 Tee
6x4 Tee
8x6 Lateral
8x3 Tee
8x4 Tee

12x3 Swedge Nipples
12x4 Swedge Nipples
12x6 Swedge Nipples
12x8 Swedge Nipples
12x10 Swedge Nipples
10x3 Swedge Nipples
10x4 Swedge Nipples
10x6 Swedge Nipples
10x8 Swedge Nipples
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6 5/8" 45° Ell
6 5/8" Lateral
6 5/8" Round End
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A *Specialized* Welding Service

HERE at Hollup headquarters we have gathered a real mass of welding facts for our customers. These facts are furnished in printed Bulletins, by mail or in person when required.

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Test the service as well as the wire—and we believe you'll join the long list of Hollup wire users who willingly testify that only experience can produce the *uniform* quality wire which cuts costs, improves products, satisfies operators.

Tell us the kind of work you are doing in shop or field and we will give you details and description of the Hollup-designed Welding Machines and electrodes best suited to your needs.

Prices are as right as the machines themselves, which are further proof — in work—of the value of *experience* in meeting the requirements of this welding age at lowest possible cost.

This illustration shows a portable motor-driven Hollup Arc Welding Machine. These machines also furnished with gas engine drive.

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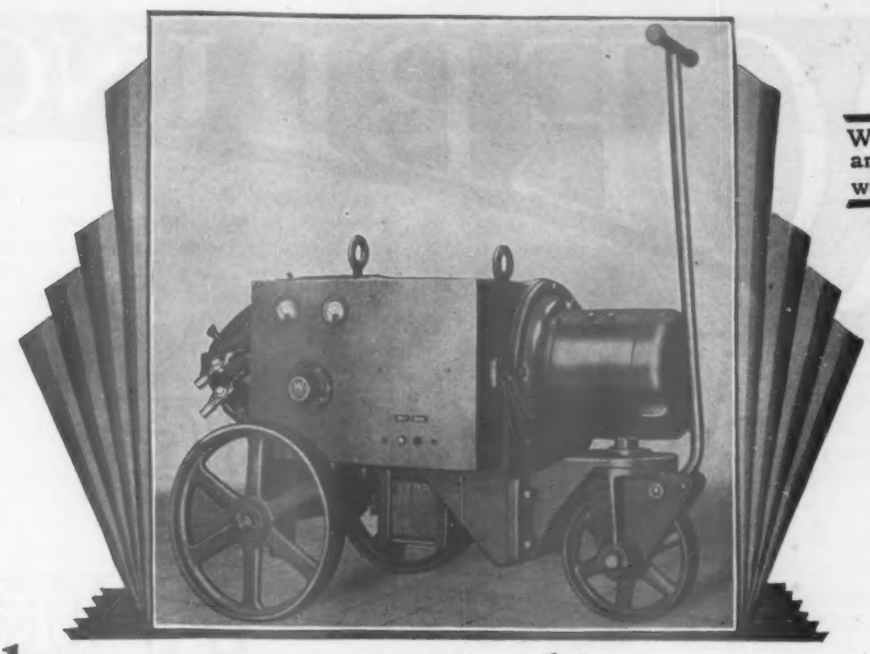

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3 *Adaptable*—A general purpose welding set, rated at 200 amperes but having a range up to 300 amperes. Suitable for shop or field structural work.

4 *Self-Contained*—The machine is a compact unit—the motor, generator, and control equipment being contained in a single rigid frame. All moving and current-carrying parts are enclosed.

In addition to this set, Westinghouse has introduced a 300 and a 400-ampere portable welding machine for use where heavier currents are needed. Write for information.

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Catalog A-529

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EDITORIAL

Westward Ho!

LAST month it required considerable space to present a word picture of what was promised to visitors at the Philadelphia meeting, and no one knows better than the visitors themselves how much better it was to be there than to read about it. The exposition was nothing short of an educational treat to anyone interested in plant management and operation. The displays and demonstrations of welding processes were especially effective in holding the attention and interest of all classes. The distance factor, of course, prevented the attendance of many in the Far West who could have profited by it under more favorable circumstances, though it seemed at times that a slightly larger attendance would have overtaxed the capacity of the exhibitors to accommodate the public demand for information. But that territory will be served. The January exposition in Los Angeles is being planned with the same exacting care, and will have much to offer both to manufacturers and users of welding products. It will be the big welding event of the winter season, worth while for all who are in any way interested in any of the processes of welding. Advance reports fully justify strong support for it from all quarters.

Discrediting the Obvious

NO MATTER what phase of welding is under consideration, there is always the possibility that scientific investigation will reveal more and more fundamental truths in the future. The public continues to take a great many things for granted as a result of purely superficial examination. The more research work is encouraged the more the public will learn that things which appear to be so are not necessarily so. This idea is illustrated in a recent demonstration which is of interest to every welding operator. It compared the capacity of different glasses for transmitting harmful radiation, and showed that this is not necessarily proportional to the capacity for transmitting visible light, in other words, that a glass which is exceedingly dark does not promise full protection by reason of depth of color. The protection of eyesight should naturally be put in the hands of those who are able to serve the welder scientifically. Profits should be protected in the same way, by selecting equipment and materials which are scientifically designed, in preference to those which look the same as far as the obvious characteristics are concerned. Real quality is sometimes hard to detect by surface indications, but it has a definite excuse for being in the product.

Business Methods in the Job Shop

LIKE every other class of business known to us today, the business of operating a commercial job welding shop enjoys the universal distinction of being different. In other words, there are a great many men engaged in this business who use this time honored excuse for not employing all of the principles of good business to the successful operation of their own plants. Many even go so far as to consider that welding is a business which cannot be improved by advertising. Some of them have tried various kinds of advertising and failed to get the results they expected. One welding shop in the East is making quite a reputation for itself, however, by the consistent way in which it has made progress by using all of the principles of business. This has been particularly noticeable in the way the firm has used advertising and selling plans to increase orders and particularly to get orders for quality work in competition with bids of lower priced competition. The enterprising manager of this institution noticed that a great many tanks which he was making on contract were to hold chemical solutions which would cause rapid deterioration of the tanks in case there were any tiny crevices on the inside. Therefore he recommended as a guarantee of longer service that these tanks be welded on the inside as well as on the outside. This recommendation brought orders for 70,000 feet of inside welding in twelve months. It shows the possibilities of building business by taking advantage of every possible opportunity to sell the services of the shop. Running a job shop may be a lot different from other businesses in some respects but getting business for the shop is by no means a hopeless task if someone is willing to make a study of modern merchandising principles.

We're All on the Same Team

MANUFACTURERS of welding equipment and materials are beginning to realize that their present markets are small in proportion to the possible markets which will open up for them as a result of development work. Consequently it becomes apparent that the energy spent in unprofitable competitive effort could better be devoted to the cultivation of the new fields of usefulness of their products. To emphasize this point it may be well to recall that the progress of welding in many instances necessitates the elimination of some other process or procedure, and that from these other methods some sharp competition may be expected. Resistance to the application of welding in the field of pipe fabrication is seen in a couple of recent attempts to improve the coupled joint. Corresponding improvements are sought by the designers of riveting machinery. And foundries are studying to improve products and reduce prices to meet the competition of welded machinery parts. The old order will stand as long as the new order is divided against itself.

The Small Welding Shop

ONE of the papers presented at the recent meeting in Philadelphia directs considerable criticism toward the small welding shop which we feel is entirely undeserved. The applications of welding to many production jobs have grown enormously in the past fifteen years and the recognition of the value of welding has made tremendous strides. There have been some cases where small shops have made failures of work entrusted to them, it is true, but we do not believe that these failures have been harmful to the progress of welding in proportion to the helpful influence which all of the small shops in the aggregate have exerted, and while it is true that there are many welding contracts being let at the present time which can only be handled by an organization having at its disposal elaborate equipment and large resources, it is equally true that whether any welding shop is going to bring credit to the welding process through its operations or not depends upon the spirit of the organization rather than upon its financial resources. There are very few of the large operators who did not start in a small way and the best large shops of the future will undoubtedly grow out of the best small ones of the present. Most of these are aware of their own limitations and have learned by experience to avoid overstepping their capacity. There are very many of them, indeed, whose financial resources are slender, but who nevertheless have enviable reputations for their ability to deliver welding of which the entire industry can be proud. The small shop continues to be a real possibility as an aid to the further progress of welding in industry, and it is our opinion that it should be encouraged and helped.

Steam Fitters
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Here is a cutting attachment that

—Changes a torch from welding to cutting in 30 seconds.

—Adds NO joints.

—Cuts to 3 inch Steel with your welding regulators.

—Can be attached with pressure on the hose.

You do a lot of welding with your Rego GM torch. Often you want to cut when it would be hard to change torches. Maybe you're at the top of a ladder some distance from the tanks, and want to change to a cutting tool. When you have a GMK cutting attachment you simply remove the extension from your GM torch at the mixer nut, put on the attachment, and do your cutting without going near the tanks to shut them off.

The objection to a cutting attachment has been the number of joints it adds to the torch—and each joint is a possible trouble maker. The GMK attachment adds NO joints. It has just two—one at the tip and one at the mixer—the same number as the welding torch.

It is made of brass forgings and special non-bending tubing. A simple positive spring valve controls the high pressure oxygen.

Guaranteed to Cut Up to 3″ Steel

The Rego GMK attachment will cut up to 3″ steel in the hands of anyone and up to 6″ when used by an experienced operator. For 6″ cutting a commercial size oxygen cutting regulator (Rego 1601) is needed, but Rego small (2″) regulators will supply sufficient oxygen for 3″ cutting. Cutting tips are made of one piece pure drawn copper.

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Catalog No. 51

THE BASTIAN-BLESSING CO.
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GMK
Cutting
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Welding Torch
$20.00 with 1 Tip

Arc Welded Bridge Construction

An Outline of the Design, Erection Procedure and Cost Data on Fifty-Foot Railway Bridge at Turtle Creek, Pa.

By A. G. Bissell*

THE construction of a large number of steel buildings using the arc-welding process as a means of joining members has demonstrated that this form of construction is successful. The process has been used in the repair of several bridges, both highway and railroad, but the first all-arc-welded bridge to carry rail traffic has just been completed. On November 1st, 1927, the Westinghouse Electric and Manufacturing Company began the construction of an all-arc-welded, single span girder railroad bridge of the through-type shown in Fig. 1. This

Fig. 1—All Arc Welded Single Span Girder Railroad Bridge.

bridge crosses Thompson's Run at Hunter's Crossing, Turtle Creek, Penna.

The two fabricated girders used in this bridge are 4 ft. 11½ inches deep and 52 ft. 5 inches and 53 ft. 9 inches long, and weigh about 11,600 pounds each. These girders were constructed in the field at the plant of the Westinghouse Company at East Pittsburgh, as shown in Figure 2. The girder flanges are built up of three plates. The flange plate, which is attached to the web, is ⅝ inch by 1 ft. 2½ inches. To this plate, by means of a fillet weld along the edge, is attached a

Fig. 2—Girders Were Constructed in the Field.

cover plate ½ inch by 1 ft. 3¼ inches by 38 ft., and a second cover plate ½ inch by 1 ft. 4 inches by 22 ft. is attached to the first cover plate. When these plates were entirely welded together, small angles were attached along the center line to act as guides in connecting the ⅜ inch by 54 inch web plate to the flanges. This is clearly illustrated in Figure 3. When the web plate was securely attached to the flange plate, the small clip-angles were removed and the ⅜ inch by 4 inch by 4 ft. 6 inch web-stiffeners were located and welded in place. Welding the web-stiffeners in place, before the second flange was installed, made it possible to weld the joint between the stiffener and the flange plate in the down hand position. The second flange-plate also had the small angles located on it, and the partially completed girder was picked up by a locomotive crane, turned over, and fitted between the angles on the flange, and was welded in place. The 6 inch by 6 inch by ½ inch angles, which are shown bolted to the web plate, were used to stiffen the web and make handling more easy. The

Fig. 3—Small Angles Attached Along Center Line to Act As Guides.
Fig. 4—Web Stiffeners Welded in Place.

end of each girder is finished by welding a ⅜ inch by 14½ inch plate to the flange-end and the web of the girder as shown in Figure 4. This photograph also shows the sole plate attached to the under end of the girder for a bearing plate and means of connection to the pier wall.

Foundation walls were installed on each side of the Run before the old bridge was removed. In making the installation the two girders were swung into place by two locomotive cranes and secured to the walls by means of hold-down bolts.

Fig. 5—All Members First Lined Up and Tacked and Then Welded Solid.

Between the girders were placed five 24 inch, 99 pound "I" floor-beams, between which were placed 18 inch, 54.7 pound "I" beam stringer as shown in Figure 5. These members were lined up and tacked, then welded solid. To make these stringers continuous, a ¾ inch by 5 inch by 24 inch plate is passed through a slot cut in the web of the floor beam at the upper flange of the stringer. These plates are welded solidly

*Arc Welding Engineer, General Engineering Department, Westinghouse Electric & Manufacturing Co.

to the upper flange of the stringers and to the web of the floor beam, giving a continuous stringer the full length of the bridge to carry the track ties. 3 inch by 3 inch by ¼ inch angles are connected between the bottom flanges of the girder and the floor beam for diagonal bracing.

In the construction of this bridge, 1,067 linear feet of ⅜ inch fillet wells and 501 linear feet of ⅝ inch fillet wells were used, requiring about 500 pounds of electrode material. The welding required 320 man hours of welder time. The entire structure was built up of 39,200 pounds of steel, and the welding of the girders was done in the field under the same conditions that would exist in the shop. The remainder of the material was cut to length and delivered to the site of the bridge, requiring no further preparation.

Tests were made on this bridge to determine the deflection and vibration by running a 185,000 pound locomotive over it at various speeds. The result of this test proves the bridge to be entirely satisfactory and it is felt that with this start more railroad bridges will be constructed by arc-welding in the future.

CARBURIZING AND OXIDIZING OXY-ACETYLENE FLAMES

By F. E. Rogers*

An oxy-acetylene weld is made by fusing and flowing metal together, thereby forming a bond uniting the opposing base metal parts. Generally, additional metal is supplied by fusing metal from a welding rod, the fused metal from the rod blending with the fused base metal.

The ideal condition in fusion welding would be realized perhaps when the base and weld metals were "bounded" at the lowest fusing temperature, and were fully protected from carbon in the flame and oxygen in the flame and atmosphere. This condition is difficult if not actually impossible of full realization. The expert welder is one who more fully performs according to these conditions than the one who uses too much heat, is careless in the adjustment of the flame and the protection of the puddle with the flame.

Now what are the effects of flame adjustment as regards the ratio of oxygen and acetylene? Everyone knows that white hot or molten steel exposed to the air quickly oxidizes or burns. The oxide scale on a forging is evidence of the attack of air oxygen on the metal. It is quite apparent that the action of oxygen is greatly increased if allowed to contact with molten steel. The surface instantly oxidizes, and if the puddle is stirred the whole mass will quickly become filled with oxide. Iron oxide has little strength, and oxidized steel is weak as compared with steel properly manufactured.

Steel for rails, beams, sheets, wire, nails and most general purposes except for tools, is made by the Bessemer converter and the Siemens-Martin open-hearth processes. One outstanding difference in steel produced by the converter and the open-hearth process is in the exposure of the molten metal to oxygen in the air. In the Bessemer process air is blown through the molten metal in the converter to burn out excess carbon. At the same time other elements and some steel are burned and ejected while some of the air is absorbed in the metal, producing impurities in the form of oxides and nitrides. While the latter are supposedly eliminated by the introduction of ferromanganese, there is no guaranty other than the judgment of the steel maker.

In the open-hearth process the pig iron and scrap are melted on a hearth with a reverberatory flame, the heat being radiated from the flames and reflected from the roof. The surface is protected to a certain degree by gases containing little or no oxygen. The molten metal is not bathed in oxygen, and a minimum of oxidation takes place. Open-hearth steel has higher tensile strength and elastic limit than Bessemer steel.

In oxy-acetylene welding we have a miniature open-hearth furnace without the reverberatory roof. We have in the properly adjusted flame a nearly neutral atmosphere intensely hot, one that produces fusion with little oxidation. This statement presupposes that the welder manipulates the torch consistently and never exposes the puddle to the atmosphere. Also that he holds the torch so that oxygen coming through the torch combines with the acetylene above the puddle surface.

If the flame is adjusted with excess of oxygen a higher temperature will be produced but the danger of oxidizing the metal is greatly increased. In fact, as a general statement, it may be said that the weld will invariably oxidize to some extent. This means a welding in which black specks are visible when broken apart, a weld that is weaker than the base metal and a weld that is more or less brittle.

If the welder errs in adjusting his flame to the other side, using an excess of acetylene, he produces what is known as a carburizing flame, that is, one that tends to deposit free carbon in the molden metal. Some of this carbon chemically combines with the steel, raising the carbon content, and some is deposited in the free form, producing graphitic carbon similar to that in cast iron.

This condition obviously is undesirable in welding. A weld should have as nearly as possible the physical and chemical characteristics of the base metal. In other words, the base metal and weld should be homogenous. The excess carbon is likely to produce a brittle structure having characteristics of inferior high-carbon steel and cast iron. Hence, the matter of flame adjustment is of the utmost importance in oxy-acetylene welding. This, too, is a test of the ability of a welder. Until the welder is able to adjust and use the truly neutral flame he will not as a rule be able to produce the best welds.

In welding cast iron we guard agains an oxidizing flame more than the carburizing flame, in general. While some grades of cast iron flow more readily under a slightly oxidizing flame, it should be used with discretion. Cast iron is easily oxidized when molten, and the oxide melting as it does at a higher temperature than cast iron persists in the solid form; it does not melt and float to the surface as in steel. Therefore, the welder is required to flux his weld to prevent oxide inclusions. A cast iron weld made without flux is likely to be hard and unmachineable, moreover brittle and easily broken.

The carburizing flame tends to deposit carbon in a cast iron weld, but the effect is not so detrimental as with steel because the carbon is added to that already present and the general structure of the weld is not greatly changed. In general, the neutral flame should be employed in welding cast iron as strictly as for steel with the exception of the more refractory cast irons requiring more heat and less affected by free oxygen.

Copper, aluminum, nickel and the non-ferrous alloys, brass, bronze and others, should not be exposed to free oxygen whether in the air or in the flame when melted. Even greater care is required to established and maintain a non-oxidizing atmosphere when welding these metals than the ferrous metals. Careful flame adjustment and manipulation reduce the need of fluxes to a minimum.

The carburizing oxy-acetylene flame is employed to some extent for casehardening low-carbon steel. The carbon content of a thin surface layer can be readily raised to the point where the steel will harden when quenched at a bright red. This is an interesting example of how the oxy-acetylene flame may be employed to perform a metallurgical operation. It also impresses the need for maintaining a neutral flame when no change is desired in the make-up of the metal being welded.—*International Acetylene Association Forum.*

**Air Reduction Sales Co.*

Preparation for Cast Iron Welding

Proper Amount and Distribution of Preheating Is as Important as Correct Welding Procedure in Securing a Good Cast Iron Weld

By F. E. Totten

THE use of bronze for cast iron welding is no doubt one of the most important developments in oxy-acetylene welding practice, but there are a number of places where the use of bronze is impractical, especially if the part is used where it will become very hot or attacked by certain chemicals.

Due to the fact that each individual welder has his own pet ideas about preheating with the result that many basic errors have been committed which has caused a loss of prestige to the welding art, the writer will lay down and discuss certain

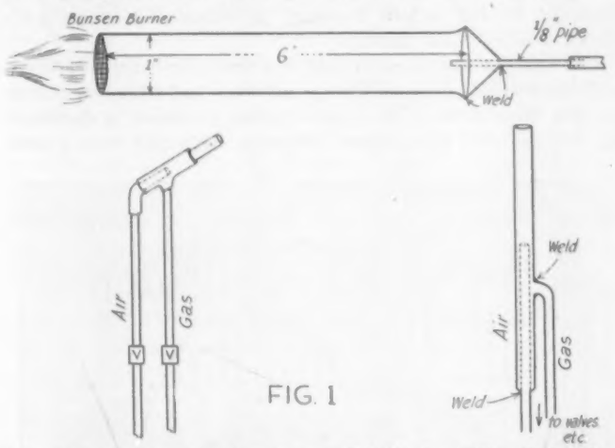


FIG. 1

Home-Made Design of Bunsen Burner Suitable for Aiding Preheating.

basic laws the observance of which will enable the welder to obtain uniformly successful results.

No shop should attempt difficult cast iron welding without proper equipment. This particularly applies to the preheating arrangements. The shop should be equipped with one or more gas and air preheating torches, one small for small castings and one somewhat larger for large castings. Then comes the Bunsen burners. These are small but very vital pieces of equipment. While too small to preheat any but the very smallest pieces of material they will hold a casting or part such as a web or spoke to the proper temperature, once it has been brought to the proper heat with the preheating torch. The Bunsen burner is nothing but a piece of 1-inch pipe 6 inches long with a mixer at one end such as is used on the kitchen gas stove. A ⅛-inch pipe is welded shut on one end and then a ⅛-inch hole drilled through the weld. This pipe is then welded into one end of the 6-inch pipe, leaving sufficient air space for the mixing of gas and air. Over the open end a coarse screen is placed which prevents the flame from burning back into the tube proper. The resulting flame is a clean blue flame, whereas if the gas is allowed to burn back in the tube it will be a dirty yellow one with little heat. There should be at least four of these burners at each welding table and attached to hose long enough to enable it to be placed on any part of the table. This hose is usually discarded oxygen or acetylene hose. Each burner is of course equipped with a valve to shut it off when not needed. See Fig. 1.

In outlining the above equipment I am assuming that the welder has access to city or natural gas and has a supply of air, either from a compressor or a rotary blower, the latter being preferable.

In preheating small objects and large ones that do not require preheating all over the following rule applies: "Heat so as to produce expansion at right angles to the direction of the line of the weld."

With this in mind we will consider some typical cases, that of the "picture frame" casting being easiest understood. See Fig. 2. The direction of the weld being along line b-c expansion must be produced as shown by arrow. This will compensate for the shrinkage of the weld metal. When one considers the weld metal as having been expanded to its limit, unless we would gasify it, and immediately starting to shrink when the welding flame is removed, the reason will readily be seen.

How much must the break be opened by the action of the

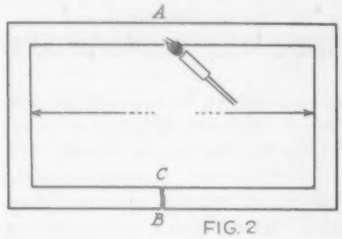


FIG. 2

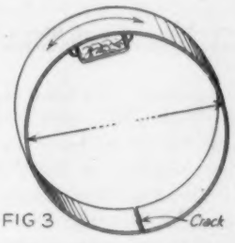


FIG 3

Expansion Must Be Produced at Right Angles to Line of Weld.

preheating flame? When making a weld the edges of the break must be brought to the fusion or welding point. This heating will cause the edges of the break to come together or toward each other.

If, when sufficient heat has been applied to the edges of the break to start welding, the edges just come together, the amount of expansion produced at A, Fig. 2. If the edges of the break do not come together under the above conditions, there has been too much heat applied at A. If the edges of the break come together before it has reached welding temperature there has not been enough expansion produced at A. The preheating or expanding flame (a Bunsen burner usually) should be left in operation during welding and after welding until the weld has cooled to a temperature corresponding to that of the opposite side. A small piece of asbestos paper placed at A will help conserve the heat of the Bunsen burner and save gas.

If the part is rather heavy, both points A and the break may be preheated to a red heat with the preheating torch, and then a Bunsen burner placed at A, to hold up expansion on that side until the weld is finished. In preheating any casting, never heat beyond a dull red.

Fig. 3 shows a large cast iron cylinder that had a crack in one edge as shown. The casting was 4 ft. high and 12 ft. in diameter. A pan of charcoal was placed as shown, the pan of charcoal extending the full length of the casting. The burning charcoal heated the solid portion, expanding it as shown by the arrow. When the heat reached a dull red the crack was welded up and allowed to cool down naturally. Light sheet iron was placed on top of the heated casting to conserve the heat.

For welding a tooth in a small gear or a gear with a rim light enough not to require preheating, see Fig. 4. Place Bunsen burners at A and B. The heat required to build up the tooth will heat the rim and cause it to expand. If provision for this expansion is not made by heating the spokes A and B the rim will be distorted and on cooling off will be left in a

strain. If, however, the Bunsen burners are used the small amount of heat supplied by them will cause the spokes to expand and become longer. This will accommodate the larger rim caused by the heat of welding and no strains will be left in the gear when cooled off. This is in line with the rule of causing expansion at right angles to the direction of the weld. The Bunsen burners should be left burning during welding and after welding until the weld has returned to a black heat.

When the gear is of heavy section it should be stood upright on the welding table, with the place to be welded on top. Build a furnace of bricks around it snugly but not too close. The back and side walls should extend slightly above the top

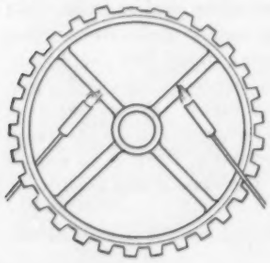


FIG. 4

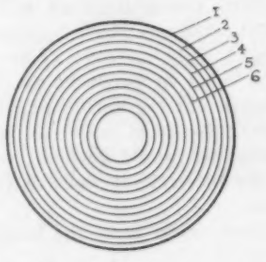


FIG. 5

Left—Application of Bunsen Burners in Preheating Light Gear Wheel. Right—Illustrating Principle of Heating Always from the Outside In.

of the gear. The front wall should extend only about half way up. This will permit of the use of the preheating torch in the space above the front wall. Cover the top of the furnace with asbestos paper or sheet iron.

Preheat with the gas and air torch, moving the torch continuously until the upper half is heated evenly to a dull red. Two Bunsen burners should be placed through the lower sides of the furnace so as to heat the lower half of the gear. The Bunsen burners should be placed so as to play on the rim. The burners will not have enough heat of themselves to heat the lower half of the gear but with the reflected heat from the upper half will supply enough heat to prevent the setting up of strains. The burners should be left burning during the welding operation. When through welding reheat carefully and cover over in the furnace or place in annealing box.

When a casting is of such size or design as to forbid of local heating, it then becomes necessary to heat it all over.

Let us at this point lay down another law or course of procedure: "Always preheat from the outside in." All castings of whatever shape should be considered as one small casting or nucleus surrounded by innumerable other and larger castings, to make up the whole. The round casting shown in Fig. 5 will illustrate the idea.

A little thought will show that the outer ring will have to become heated and expanded first to permit the second ring to expand, the second for the third and so on. Therefore if the preheating medium is charcoal, the charcoal should be placed around the casting but not underneath or on top of it. When using a gas and air torch or kerosene burner, start heating the outer edge and gradually work the heat toward the center. This means that the torch must be held in the hands and kept continually moving in order to secure an even heat.

You who have had trouble welding cast iron heater sections, on account of cracking during heating or cooling, will have no more trouble if this method is followed. You no doubt have welded water jackets of automobile engines and on cooling have found the bores distorted so much as to necessitate reboring or grinding.

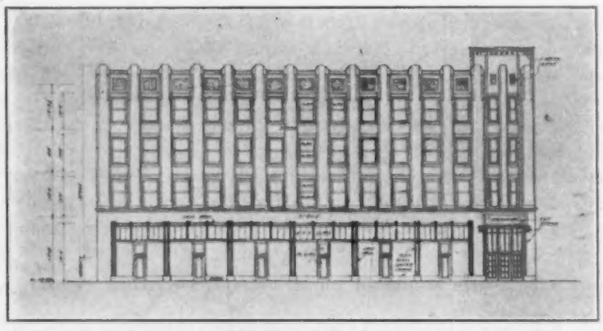
Mix up a heavy mixture of graphite and oil or grease and paint the bores well. Then place in the preheating furnace in the running position. The block should be raised above the floor of the furnace the height of two bricks. Now lay charcoal around the block, being careful that the charcoal is not high enough to reach the lower part of the water jacket, and at no point should the charcoal touch the casting. In other words, heat the block with the heat that raises from the charcoal and not from direct contact with it. When heated to a dull red heat weld in the furnace if possible. If not possible, remove from the furnace and cover with sheet asbestos and weld as quickly as possible. When the welding is finished, reheat and let cool down with the furnace. When the bores are swabbed out it will be found that they are not scaled and the pistons will fit as snugly as before.

To build up valve seats heat as described above and weld with a small tip, puddling carefully. That is, be careful not to leave any blow holes in the weld as this would make the seat unfit for use.

ARC WELDING ENTERS COMMERCIAL BUILDING FIELD IN CLEVELAND

Work was recently started on the first unit of a group of commercial buildings which will be erected on upper Carnegie Avenue, in the heart of Cleveland's fashionable up-town shopping district. The project which includes a twenty story tower building is being promoted by the Austin Company, Cleveland, Ohio, nationally known architects and builders.

The building now being erected is a four story structure which will house retail stores on the ground floor and offices on the remaining three floors. The front elevation as shown in the drawing will be faced with Indiana Limestone supported by a granite



No Rivets or Field Bolts Used in the Shop and Field Fabrication of This Building.

base course. Provision has been made in the design of the building so that every alternate column in the front of the store rooms can be removed thus making available at any time either 17 ft. or 34 ft. wide store fronts.

Intense interest is being displayed in the unique design and the construction methods employed in the fabrication and erection of the structural steel for the frame of the initial building. By the use of arc welding for making all connections, all punching and riveting are being eliminated in the shop fabrication of the structural members; field bolts and rivets are also eliminated from all connections being made in the field. Much favorable comment has been made by those situated near the scene of building operations on the absence of the deafening noise of riveting hammers heard on most steel erection jobs. Silent erection is fast becoming an important factor in favor of arc welding process.

A design which permits such an innovation in construction methods cannot of course be based on the traditional designs of steel structures but rather must be founded on the possibilities of arc welding and the proven strength of welded connections. On this basis, the owners employed all the known economic advantages of arc-welded steel construction in designing the steel structure. The use of continuous beams instead of the usual multi-story columns is one of the unusual features in the design of the steel frame work.

The building was designed and is being erected by the owner, The Austin Company. The structural steel was fabricated in building owner's fabricating shop, the arc welding being done at the mill and in the field by The Lincoln Electric Company, Cleveland, Ohio, manufacturers of electric arc welding machines and equipment.

Welding in Aircraft Construction

Importance of Oxy-Acetylene Process—Chrome Molybdenum Tubing the Predominating Material—Importance of Proper Design—Technique for Welding

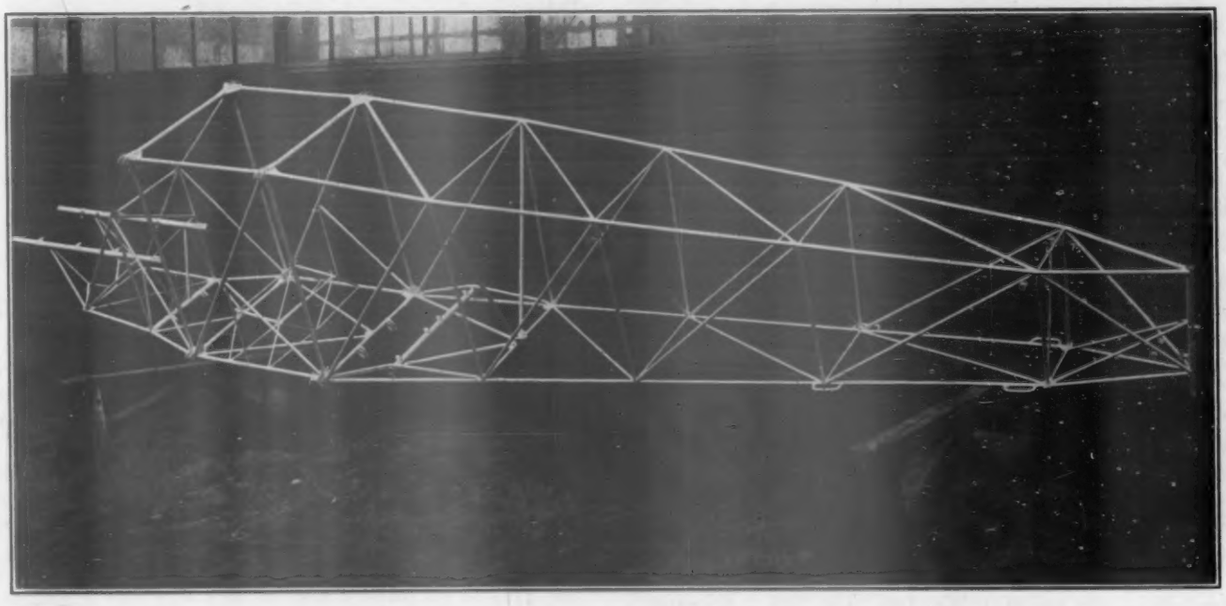
By J. F. Hardecker*

NO single factor offers a greater contribution to the successful construction of the modern commercial airplane than does the oxy-acetylene flame. Riveted joints and bolted fittings, laboriously designed and expensively made, held out for a long time in the minds of the truly cautious. Not by economic pressure, or sales argument, nor yet by laboratory test or theoretical computation, but by sheer merit of repeated actual demonstration has welding won its preeminent place in the aeronautical sun. Plane after plane, by the hundreds, by the thousands, are built of welded steel tubing—and not a single significant failure even varies the records of bona-fide manufacturers of modern planes. The perfection attained is so high that at present the welded fuselage is standard in airplane construction.

Col. Lindbergh's "Spirit of St. Louis" and Chamberlain's Columbia-Bellenca plane, were built entirely of oxy-acetylene welded chrome molybdenum tubing. The planes used by Lieut. Maitland and Commander Byrd were also welded jobs, using both chrome molybdenum and mild steel tubing. In fact, the record might be stretched indenitely—for the welded steel fuselage is the mostly highly developed and rigidly adhered to standard in aircraft construction.

The predominating material in welded airplane construction is chrome molybdenum tubing, SAE steel number 4130X. The minimum tensile strength of this material is 95,000 pounds per sq. inch in the as drawn condition, with a minimum elongation in 2 inches of 12 per cent. Used as thin walled seamless tubing, it is an ideal material, for with the welded joint being stronger than the adjacent metal, it gives us a direct material, without any subsequent heat treatment. It is also possible to reduce the cost of a structure without reducing its efficiency or strength by using mild steel tubing for the compression members and chrome molybdenum for the tension; as they are very satisfactorily welded together.

Successful welding in aircraft is not so much a function of the skill of the welder as it is of the designer, who must know by experience what constitutes good welding design. He should make logical connections and joints and avoid all sharp transitions, especially in the wall-thickness of the tubes to be joined. Otherwise, while the steel of the one tube becomes liquid, the other part has not reached a sufficient temperature, which hinders the cohesion of the metal of the two parts, and prevents the forming of continuous crystals in the joint.



Typical Welded Fuselage Construction Which Combines Maximum Strength of Joint with Minimum Weight.

The general practice in welding is to use high test or mild steel welding rod for all purposes. Chrome molybdenum rod is sometimes used; but it has no advantages except if the joint is to be heat treated, a requirement which seldom exists. A clean joint, if of course, an obvious essential.

Oxy-Acetylene welding has greatly simplified the design of airplanes. Complicated detail fittings, with all angles, etc.,

* *Chief Draftsman, Naval Aircraft Factory, Philadelphia, Pa.*

fully detailed for separate bench manufacture, are no longer necessary. The fuselage, tail or wing structure is drawn as a unit and assambled in a single jig. The resulting structure is really a single unit, eminently more fitted to successfully withstand a crash than the bolted and riveted up job.

Besides the self apparent saving in shop costs, the saving in weight is of prime significance. Every pound saved in the structure of a plane means an additional pound of pay load that may be safely carried—either in passengers, freight or fuel capacity. Not only is the resultant saving in the major structure; but there is also the matter of ease of attachments for all the various accessories, attachments and parts, which by welding become an inherent part of the main structure, and strengthen rather than weaken it.

Redesign is a simple matter in the welded structure. Tubes of heavier or lighter gauge may be inserted without difficulty, and if necessary even a main structural assembly, such as the fuselage, may be lengthened or shortened without great difficulty. Changes may be made with the minimum of recalculation, and the necessity of elaborate drawings is eliminated. The absence of patterns, drilling jigs for fittings, changed bolt lengths, etc., all contribute to the ease of changes in a welded structure.

Ease of repair is another major point in favor of the welded structure. The damage tube is merely sawed out and replaced; and the repair is thus localized and confined to the damaged tubes only. The oxy-acetylene flame does not require an elaborate apparatus, so that repairs may be made at field stations, without the necessity of returning the plane to the manufacturer. The parts to be repaired by welding should always be cleaned by sand papering or brushing with a wire brush. A file should not be used, as with thin welded tubing, this reduces the cross section and consequently the efficiency of the joint. A telescope joint of the fish mouth form is decidedly preferable to a butt joint in making repairs to a member. Chrome molybdenum tubing should always be used in replacement as a matter of safety. If only mild steel tubing is available, the heavier gauge equivalent to the corresponding gauge of chrome molybdenum tubing should be used. Splices should always occur as close to the strut point as possible, as the greatest stress in a tubular member occurs in the middle. With a little care and forethought, distortion due to the contraction and expansion of the metal can be avoided.

Welding as a production process also finds application in certain aircraft engines. Castings, as is often the practice, have their minor defects corrected by welding, before they are used in the engine. Exhaust and intake manifolds, exhaust tubes of various forms and other engine accessories, are often built of welded tube and sheet parts.

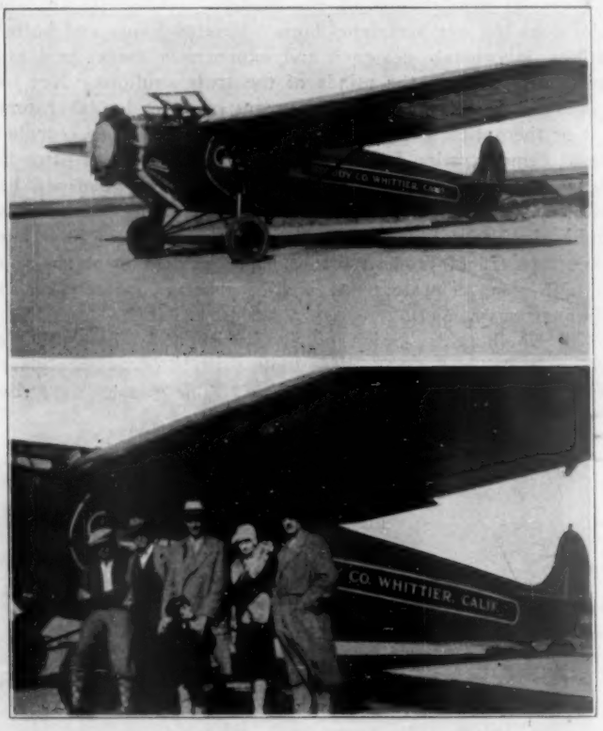
Welded aluminum sheet is one of the most satisfactory solutions of the tank problem—gasoline, oil or water. Due to the involved shape of these tanks, and the necessity of baffles to prevent surging of the liquid, it is necessary that they be strong and tight. The best method is to bend up the edges of the sheet and melt together the flanges so formed into a bead, without the use of a filler rod. The flux is important, and as all aluminum fluxes are corrosive, they must be thoroughly removed after welding. Rolling beads into the metal around the weld, relieves the strain induced by the high thermal expansion of the metal in welding. Welded duralumin tanks have been successfully produced in experimental production; and with the development of the art, should find their place in actual quantity production.

This brief description should give some conception of the significance of the oxy-acetylene flame in aircraft production. Fortunately, as in most other cases, the scope of its application is rapidly expanding. No single process has done so much, or promises to do even more, for the aircraft industry.

STOODY COMPANY USES AIRPLANE FOR CONTACTING BRANCH OFFICES

A Fokker Special six-passenger cabin monoplane was recently purchased by the Stoody Company to be of use for business purposes. At present, Mr. James C. Blake, their general sales manager, his wife and three year old daughter, with Mr. Chester Mott, Sales Manager of The Purox Company of Denver, and the pilot, Vernon Durrell, are flying from Los Angeles via Oakland, Reno, Salt Lake, Cheyenne, Denver, Kansas City, Chicago, Detroit, Cleveland, Erie, Pittsburgh, New York, returning to Los Angeles via southern points, including Tulsa.

Mr. Blake and Mr. Mott are calling upon their branch offices and jobbers across the United States. The Stoody Company are manufacturers of special alloy welding wire, hard surfacing metals, and a diamond-like substance known as Borium. The Purox Company are manufacturers of welding and cutting equip-



Above—Fokker Six-Passenger Monoplane Owned by Stoody Company. Below—Vernon Durrell, Pilot; M. H. Turner; Chester Mott, with Jethelyn Blake; Mrs. Blake, and James C. Blake.

ment and gases, and through their offices located in the large industrial centers of the United States are distributors of the products of the Stoody Company. This trip is expected to take about a month.

Although the airplane is not yet in use by all business houses for purposes of this kind, the Stoody Company think that within a very short time it will be. They have found that from their experience this means of contacting their representatives is a highly profitable one.

The cabin of the plane is fitted up with four very comfortable seats, icewater, wash bowl, toilet, and a refrigerator. The party have a card table with them which fits in between the four seats. The pilot is located in a cockpit just forward of the passenger cabin. Just aft of the cabin is a large baggage compartment, and this is full of suitcases, briefcases and hatboxes. The plane is powered by a Pratt and Whitney Wasp Motor. The fuselage frame is of all welded tube construction, and welding is noticeable on some of the visible parts of the wing construction also. So far the plane has given as good service and as little trouble as a high priced auto. It was just a matter of stopping occasionally and getting gas and oil, and the passengers feel assured that it will continue to perform in that manner for the remainder of the trip.

Welding on Railway Cars

A Reduction in Cost of Over 20% on New Construction and 80% in Maintenance Effected by Arc Welding

By R. L. Scollard*

THE rapid development of the electric arc welding process and its broad application in steel fabrication has caused the Fleischman Transportation Company of Cincinnati to adopt it as a standard process in the shops of the company.

The amount of welded construction in this plant today was not decided upon in an instant, but represents a gradual growth resulting from three years of experimental and development work which has entailed a considerable amount of redesigning of parts by Mr. Nicholas Schaefers, the general superintendent.

The first semi-welded car has been in service under heavy duty for two years and has never been returned to the shops for overhauling. This is an unusual record, for these cars haul acid, and a year's run has heretofore been considered very satisfactory because the slightest leak of the wooden tank caused a deterioration to begin along the rivet line of the centre frame. This deterioration generally resulted in the car being returned to the shop where the fame was either replaced or spliced, which was costly not only in respect to the actual labor cost but also the loss of earnings while the car was out of service.

The car shown by Figure 1 had the frame spliced by arc welding, which required approximately four hours of welding by the operator. A comparison of the cost of this welded splice with the former method of riveting will prove very interesting to car men who are not only rushed for time but are also held down to small appropriations for general maintenance.

Cars with these welded splices have been in service nearly three years and the gratifying result has been that acid leaks have no serious effect upon the welds. Any leaks developing in the wooden tank may generally be stopped and it is not necessary to take the car out of service as no serious injury has been done to the car frame.

These cars have sustained the average number of wrecks without a failure of the weld and their performance has been eminently satisfactory to those railway officials who have had jurisdiction over such matters.

Welding Engineer, Una Welding & Bonding Co.

The savings in money and time to the car operating companies and the railway companies in general plus the proof of strength which is offered by these cars mentioned here will demand an attention which will make many common practices of today obsolete.

A new car was recently fabricated by welding at a cost of thirty-four hundred dollars as compared with a cost of forty-two hundred dollars for riveted construction. This saving was in no way due to any reduction in the cost of labor or materials but was entirely due to the redesigning, which welding permitted, and the decreased time of assembly.

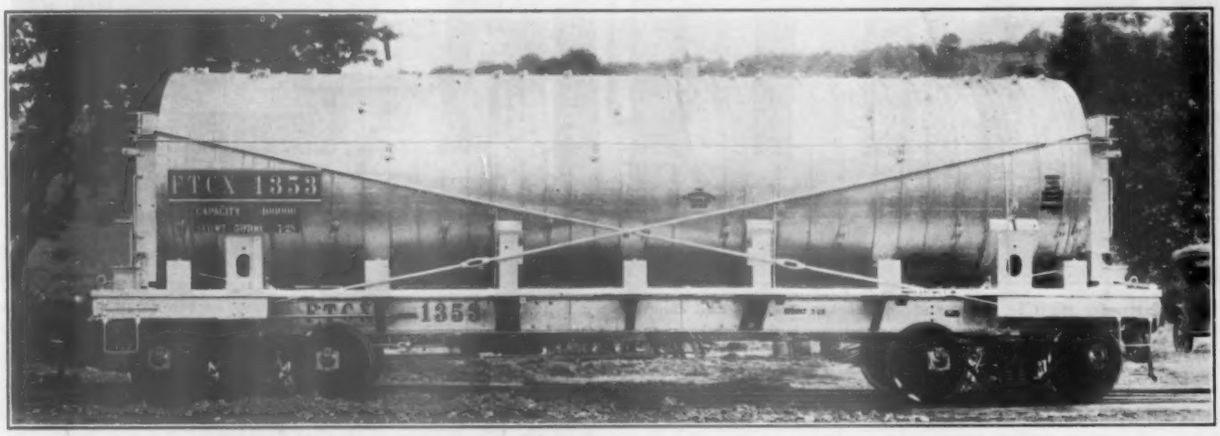


Fig. 1—Only Four Hours Required to Splice Frame of This Car by Arc Welding. Splice Can Be Seen at Center of Frame.

Figure 1 shows the welded splice as applied to the car frame and also shows a replacement of the deteriorated part of a channel on top. A cutting torch was used to remove the corroded portion and a new piece was inserted and welded. Ten one inch holes were punched in the splice plate and by close observation it can be seen where the welding was applied through these holes to the old centre sills. This practice is not really necessary but offers an added factor of safety which can, if desired, be added. The entire edge of the splice plate was welded with a fillet of forty-five degrees.

Fig. 2—Construction of Center Sills

Figure 2 shows the construction of the centre sills. The application of the arc welding process in fabricating these members resulted in a saving of several dollars per section. The angles had been punched preparatory to riveting so the holes were used as described in the previous paragraph.

Figure 3 shows an end header which must withstand the

tremendous thrusts of the entire loaded tank when a sudden start or stop is made. The welding of this member and the general redesigning was a considerable factor in the reduction of cost of new car construction. A further advantage of this welded type of header is the entire elimination of tank shifting.

Figure 4 shows this end header in position on the car and also the light welded cradle which has replaced a heavy cast-

matter of reduced costs, the saving of labor and material with greater strength and lighter weight as a net result, will be entitled to some serious thought by car operating and railway officials and the greater strength plus the lighter weight will not prove offensive to the railway train operating officials.

While the above discussion was being prepared for publi-

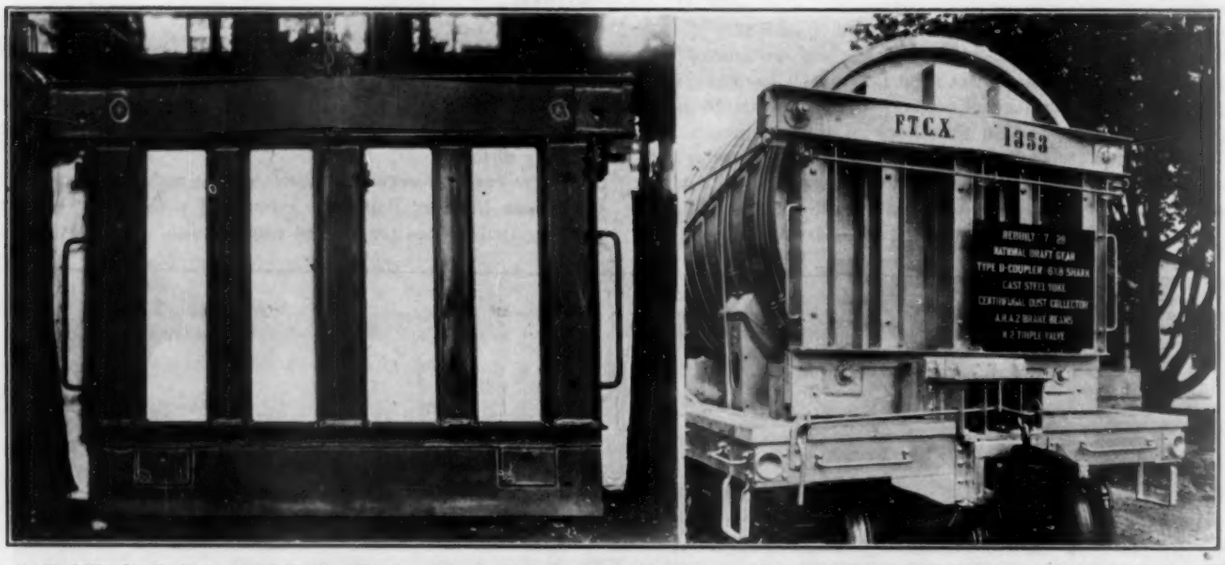


Fig. 3—End Header Built to Stand Sudden Shocks. Fig. 4—End Header in Position on Car. Also Shows Light Welded Cradle, Replacing Heavy Casting.

ing. This cradle was redesigned to give a greater holding surface and with this desirable feature it weighs forty per cent less than its predecessor.

Figure 5 shows one section of the welding department and the method of assembling the cradles. The one in the background holds the tell-tale marks of good penetration of the

cation one of these semi-welded cars was in a train which was wrecked. The trucks were knocked clear and the car careened along track colliding with other nearby cars. The wooden tank was so protected by the welded end header that not one leak was sustained. Previous wrecks of similar nature always resulted in damaged tanks and it is commonly agreed that

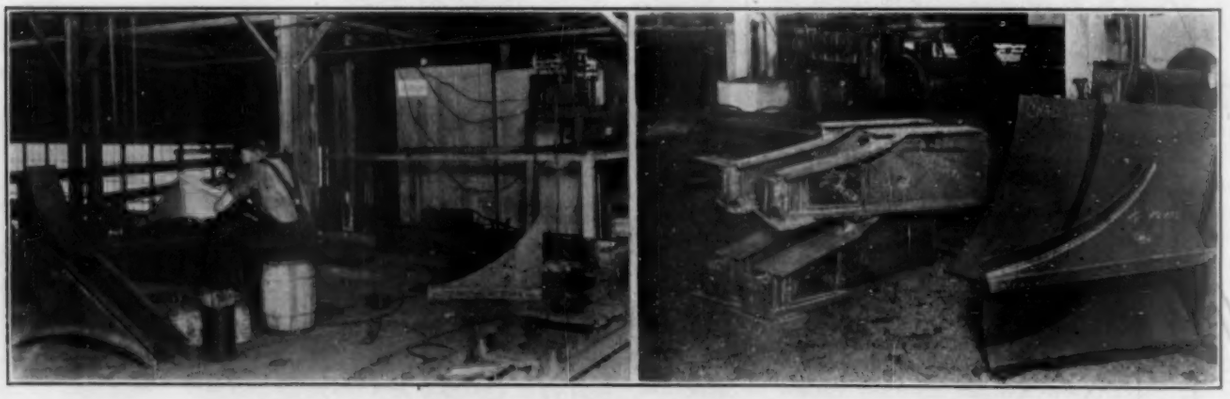


Fig. 5—Section of Welding Department. Fig. 6—Details of Cradles and Bolsters.

weld and is the operator's guarantee of workmanship as he is provided with first class equipment and wire.

Figure 6 shows a group of cradles and bolsters and the construction is very clearly defined. In the background can be seen centre sills in production.

This story of how the Fleischman Transportation Company has successfully applied arc welding in the fabrication of acid tank car frames does not represent pioneer welding in the railway tank car field but it describes an up-to-date and more complete application both on new cars and in maintenance work than previous starts made some years ago.

In summarizing this discussion it is very apparent that the

the welded structure of this car was responsible for the minimum amount of damage.

Figure 7 shows minimum damage and, regardless of the terrific strains subjected to, no fracture of any weld can be observed.

Figure 8 gives a most complete picture of the strain subjected to by the fish belly type centre sill which only resulted in the angle iron being bent. It is doubtful if a riveted angle would have withstood this without rivets shearing.

Figure 9 presents a very distinct view of the opposite side of sill and also gives an excellent view of a real weld applied with high grade material by a qualified operator.

Figure 10 pictures the results of a tremendous blow applied most favorably to test the strength of the weld.

The reader must not forget that this car was knocked completely off its trucks by the impact received and this fact should prove beyond question the dependability of arc welding

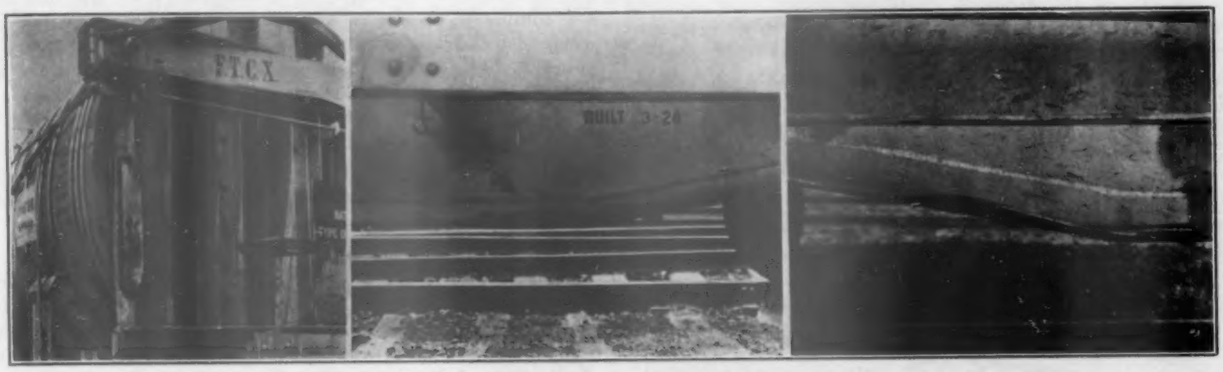


Fig. 7—No Fracture of Any Weld After Collision. Figs. 8 and 9—Nothing More Serious Than a Bent Angle on Center Sill. No Rivets to Shear.

under the most severe emergencies. The experienced car repair officials will recognize the minimum cost of restoring this car to service as compared to the probable cost had it been of the riveted type.

In closing, it may be added, the wrecking crew found it very advantageous to slip a hook into the hole cut in cradle (see

Fig. 10—This Weld Received a Tremendous Blow, But Stood the Test.

cut No. 1 or No. 4) to lift car back on to the trucks and as this cradle is formed of ¼ inch plate a slight bend in plate was caused with no ill effects upon the weld.

[*Acknowledgment is made to Una Welding and Bonding Co., Cleveland, Ohio, who furnished the accompaning illustrations.*]

A. S. S. T. PUBLISHES 1929 EDITION OF HANDBOOK

After five years of work in assembling a volume of comprehensive and concise information on metallurgical practice pertaining to the manufacture, treatment and use of metals, the American Society for Steel Treating has published its first bound volume of the Handbook. This reference work has been published in loose-leaf form for five years. It is proposed to have the Handbook issued annually in bound form.

The material has been prepared from sources considered reliable and by men of high technical standing. Each article has been reviewed by many members of the Society before being approved for publication by the Recommended Practice Committee.

Notes are included on the welding of stainless steels and also of alumium alloys. There is also much valuable data on the physical and chemical properties of metals which relate to the welding of them. In addition to ninety pages of general data, there are chapters on Heat Treatments, Carburizing, Steels and Alloying Elements, Cast Iron, Pyrometry, Metallography, Testing, Furnaces, Heat Application and Refractories, Forging, and Nonferrous Metals. There is also a very complete General Index. The Handbook contains 600 pages exclusive of the Index and Buyers Guide, and is well illustrated with cuts and charts. It can be obtained from The American Society for Steel Treating, 7016 Euclid Avenue, Cleveland, Ohio. Price, $7.50.

BOOK REVIEW

INDUSTRIAL FIRE HAZARDS AND ENCYCLOPEDIA OF HAZARDOUS MATERIALS by Gorham Dana, manager of the Underwriters Bureau of New England, and William D. Milne, superintendent of surveys, the Underwriters Bureau of New England, and chairman of the N. F. P. A. Committee on Manufacturing Hazards.

A reference and textbook on Special Hazards for Fire Insurance Inspectors, Engineers, Underwriters, and Agents. Also of value to Fire Department Members, Architects, and Manufacturers.

The authors have condensed into one volume a detailed description of the processes and fire hazards of the principal American manufacturing industries. The book is in two sections, with an introduction explanatory of the theory of fire, its spread, its causes, and methods of extinguishment.

In the first section the important industries are described under about 70 headings arranged alphabetically. The stock, process, fire hazards and fire record of these are discussed, together with suggestions for proper construction and protection. Numerous references are also given for additional information. This section is generously illustrated by cuts of machines, processes, devices, etc.

The second section, Encyclopedia of Hazardous Materials, contains an alphabetical list of the more important chemical materials, oils and trade compounds found in industry and commerce. The physical characteristics and fire hazards of these are described.

There is a very complete index covering the entire volume.

Much of the material has been previously published by the Underwriters Bureau of New England in pamphlet and "card information" form. This has been carefully edited, brought up to date and considerably enlarged. The book contains 948 pages and is of convenient size (1½x5½x8 inches). It is printed on light high grade paper and bound in dark blue cloth. Price, $4.50 a copy ($4.80 postpaid); $22.00 for 5 copies postpaid; $50.00 for 12 copies postpaid. Orders may be sent to National Fire Protection Association, 40 Central St., Boston, Mass.

NOVEL CONSTRUCTION EMPLOYED IN HOUSTON AIRPORT HANGERS

The city of Houston, Texas, prominent convention city and famous as a gulf port, has recently erected three large hangars at its airport for the convenience of its flying guests. The hangars are of the all-metal type, corrugated iron sheeting being used to cover the arc welded steel super-structure, rendering the hangars absolutely fireproof.

After estimates had been received on various types of construction, the Houston Airport Corporation awarded the contract for the erection of fireproof hangars of arc welded steel constuction. The greater rigidity and strength of this type of

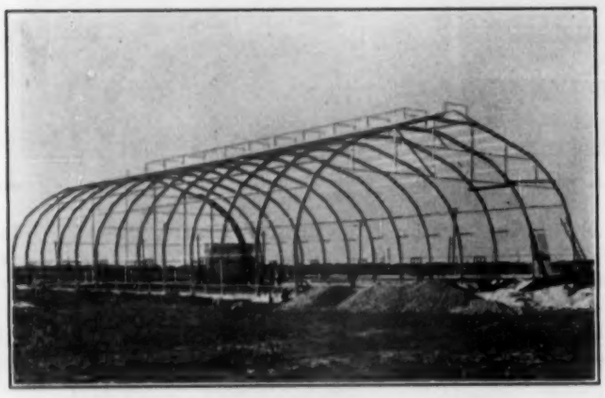


Fig. 1—A Completed Welded Superstructure.

construction coupled with its low cost were the deciding factors that caused the awarding of such a contact. The lowest bid submitted for wood constructed hangars was 25 percent higher than the figure for arc welded steel construction and the lowest estimate based on riveted steel construction was 40 percent higher.

Though these hangars were the first to be built employing the new method of construction, ample proof of the greater

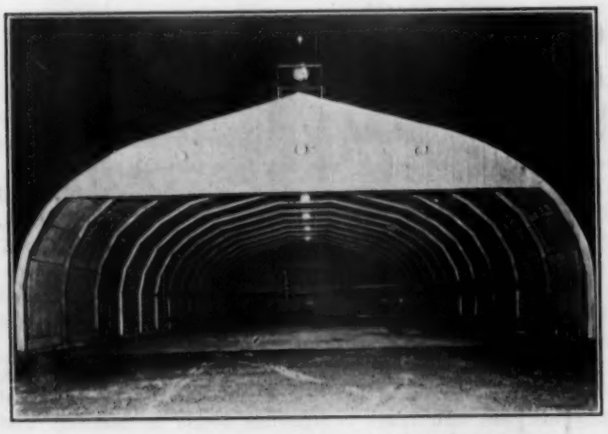


Fig. 2—Showing the Clear Ceiling and Simplicity of Design.

rigidity and strength of arc welded steel fabrication was offered the owners, in the large commercial and industrial buildings which have been erected in various parts of the country and whose steel framework has been entirely arc welded. The success of the new process in the structural field is attested by its increasingly rapid growth.

Credit should be given the C. J. Frankel Company for the unique design of the hangars as well as their rapid erection.

The three hangars are typical, being 75 feet wide, 125 feet long and approximately 50 feet high. The arches are made up from channel shape sections cut to form the arc when butted end to end and welded together. The entire fabrication of the arches was completed on the ground, an arch being raised into position and held in place by the welding of the channel purlins to the arches. The framework of one hangar is shown in the process of erection in figure 1. The columns at the closed end are also channel sections. The framework of the monitors are composed of angles and channels. The completed arc welded steel framework of one of the hangars is shown in figure 2. The steel sash in the sides and end wall were arc welded in place, in fact there are no bolts or rivets in the framework of the three hangars.

All the fabricating work on the three hangars was done in the field, all connections being made by the electric arc welding process. Two portable gas engine driven Lincoln "Stable-Arc" welders were used to supply the welding current.

The simplicity of the novel design due to the elimination of all trusses and other forms of roof bracing is an economic factor which should favor arc welded steel construction for future hangars. Another advantage of this design, due to its clear ceiling, is its practicability for hangars for blimps and similar lighter than air crafts.

HOW ACETYLENE SERVES METAL WORKING INDUSTRIES

When the International Acetylene Association meets in November for its twenty-ninth annual convention, plant executives and engineers from prominent industrial concerns in the United States will be in attendance for the purpose of discussing methods which have been developed to make profitable use of the oxy-acetylene welding and cutting processes. Many large industrial concerns have made remarkable showings by the aid of these processes during the past year and the detailed description of methods followed, along with experiments of how much they mean in increasing the efficiency of plant operations, will form a program which will hold the interest of responsible men in the metal working industry as well as that of the manufacturers of acetylene and the equipment necessary for its use.

Complete details of the program are not yet available for publication but it is reported that it is built around two main thoughts. First, is the need and desirability of educating men in industry to the real value of acetylene and processes which employ it, and the second, is detailed discussions of definite uses for the oxy-acetylene processes in applications which are particularly significant at the present time. One portion of the program will include the presentation of a list of products which are manufactured by oxy-acetylene welding and cutting, and other portions will discuss such important applications as pipe welding, bronze welding, hard facing, welding of non-ferrous alloys, machine welding and cutting. It will be shown in connection with the subject of pipe welding that there is no kind of pipe installation where metal pipe is used where it is not susceptible to improvement by the use of welding, whether for part of the assembly or for the entire installation.

There is probably no other metal working process which is so universally used as the oxy-acetylene process. Practically every plant or work shop of any size in the country has at least one set of equipment available for use. However, there are many thousands of plants which use the apparatus for a single purpose and the educational work of the International Acetylene Association is directed toward showing in how many cases the use of equipment already installed can be very much extended with considerable financial benefit to the user.

The meeting will be held November 14, 15 and 16 at the Congress Hotel, Chicago, instead of at the Stevens Hotel, as previously announced.

TENANTS UNDISTURBED BY HALF MILLION DOLLAR ALTERATIONS TO OLD BUILDING

Tenants of the ten-story Rose Building, Cleveland, Ohio, are carrying on business in their regular manner undisturbed by alterations to the building which will cost approximately a half million dollars when completed. It is said to be the largest building operation of its kind ever attempted in Cleveland.

This office building, which houses mostly physicians and dentists, was erected in 1898-99. Due to its obsolete de-

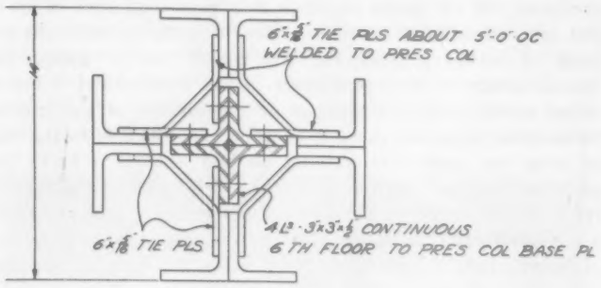


Fig. 1.

sign many difficulties were encountered by William Robert Powell, architect, and Carson G. French, structural engineer, of Cleveland, in the preparation of plans for the present alterations. One of the greatest difficulties presented was the loss of most of the drawings showing structural details of the old building. The obstacle was overcome by the decision to cut the steel in the field whenever necessary, with a gas torch, and to make all connections to the old frame work by the electric arc welding process.

By use of this modern method of joining steel it was necessary to make only small openings in the old walls uncovering only the face of the old steel where the connections were to be made. In this way much wrecking was eliminated and due to the fact that the arc welding process is silent, tenants

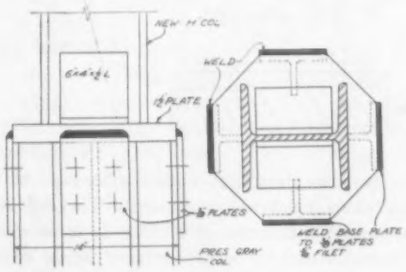


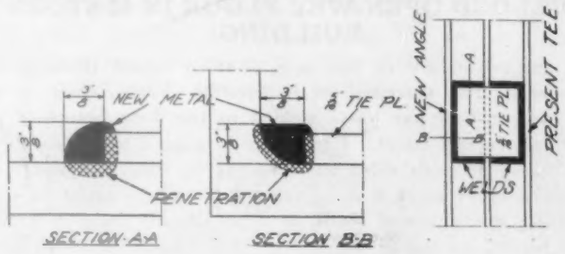
Fig. 3.

of offices adjoining the building operations were unmolested. In fact, teeth are being filled and ailments treated in rooms adjacent to where the welder operator is welding. It is estimated that the owenrs of the Rose Building are saving thousands of dollars in rentals by the use of arc welding for making field connections.

Included in the alteration project is the addition of four stories on top of a portion of the building which was originally six stories high. The old columns in this section of the building were not originally designed to carry additional load. They are of the Gray type, made of four tee shapes held together by straps riveted to the legs of the tees, thus the columns were given a circumference octagonal in shape, the center of the columns being open. To stiffen these columns and give them greater load bearing capacity, sections in the shape of a cross made up of angles were inserted in the hollow center of the existing columns. The new steel was then joined to the old at five-foot intervals by plates welded to the legs of the angles and to the legs of the old tees. Figures 1 and 2 show a plan and elevation of a column reinforced in this manner.

Where the six-story columns were continued with new steel for the four additional stories the connections were electric arc welded as shown in Figure 3.

New elevator wells were made in the old building. In framing these in, the new steel was cut to size with a gas torch and then butt welded to the existing beams with the electric arc as shown in Figure 4. Cutting with a gas torch and fitting was due to the fact that the old beams could not be located from the available drawings of the old structure and, as mentioned before, it was found to be more economical to cut and fit in the field rather than uncover the beams for accurate dimensions at the time structural drawings were made. Figure 5 shows arc welded connections where



DETAILS OF WELDED CONNECTION OF TIE PLATES TO COLUMN REINFORCEMENT

Fig. 2.

new beams were inserted to relieve old beam of additional load.

The beams which carried the roof of the low section of the building were not deemed to be of sufficient size to carry the seventh floor. To give them the necessary strength track rails were welded to the top flange of the existing beams.

Welded steel bar joists are being used in the new addition. These are held in position by welding the ends of each joist

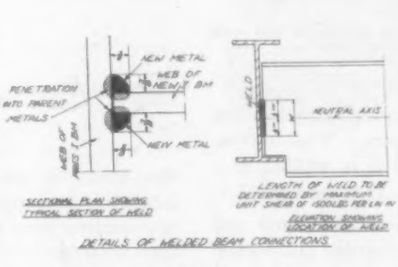

NEW METAL
PENETRATION INTO PARENT METALS
NEW METAL
SECTIONAL PLAN SHOWING TYPICAL SECTION OF WELD
NEUTRAL AXIS
LENGTH OF WELD TO BE DETERMINED BY MAXIMUM UNIT SHEAR OF 13000 LBS PER LIN IN
DETAILS OF WELDED BEAM CONNECTIONS

Fig. 4.

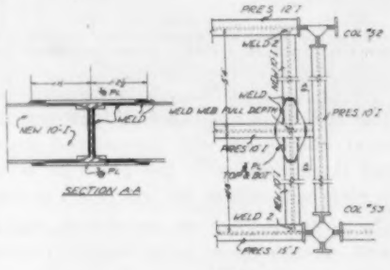


Fig. 5.

to the beams. The joists are tied transversely by welding a half-inch round rod to their bottom cords.

Arc welding is also being used by the plumbing contractor, The Smith & Oby Company of Cleveland. Sections of 10-inch pipe which form the main steam riser are joined together by arc welding. The new process eliminates the use of threaded connections and fittings. The pipes are simply butted together and welded. Pipe joints made in this manner are tighter and resist corrosion far longer than threaded connections. This new method also is more economical when the elimiantion of all threading and use of fittings are taken into consideration.

The actual labor savings effected by use of arc welding in place of riveting on this project cannot be accurately estimated due to the fact that in many instances conditions prevented the possibility of employing the traditional method of joining the steel. However, it is believed that had conditions permitted riveting, the labor cost sheets would prove

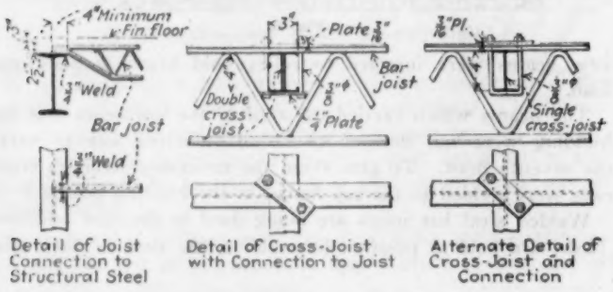
that arc welding is an economical method of making field connections.

As stated before, the use of arc welding on this particular structure made it possible for the owners to obtain full revenue from their building while the alterations were in progress, as well as eliminating much of the wrecking that would have been necessary to give riveters room to work while making connections to the old frame work.

The Forest City Structural Steel Company, fabricators and erectors of the structural steel for the Rose Building used Lincoln "Stable-Arc" welding machines in doing the field welding. Operators were required at intervals to weld samples which were tested to satisfy requirements imposed by the local building commission.

WELDED OPEN-WEB FLOOR IN 42-STORY BUILDING

A unique feature of the new 42-story Grant Building in Pittsburgh, Pa., described in *Engineering News-Record* is its use of open-web bar joists welded to the floor beams of all floors above the street. Each joist is welded to its supporting beams on both sides by welds ¼ in. long. In order to assure a more rigid floor construction and to assist in distributing concentrated loads, a 3-in. I-beam cross-joist has been placed on the center line of each panel, bolted to each bar joist and welded on both ends to the floor beams.



Chords of bar joists are wide sections welded to floor beams so that each panel will act as a slab. Note continuous bottom chord and web.

The bar joists are small Warren-type trusses, with top and bottom chords of wide tee-shaped members. The bottom chord is continuous to the bearings, where it is welded to a web plate and this to the top chord to form an I-section.

The web members, of round rods, are continuous from end to end of each truss, being welded to the chords. This type of floor construction was chosen for its light dead weight and for the advantages it offered in installing pipes and conduits between the upper and lower chords.

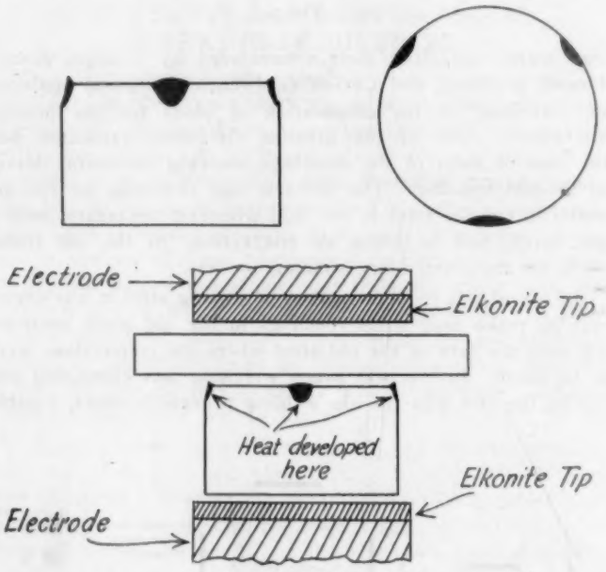
Welding the bar joists to the floor beams is a new departure. Previously such joists have been attached to the beams by means of clips which serve only as a temporary attachment until the metal lath and concrete are in place. It is believed that by the use of this welded connection and the utilization of cross-joists a considerable stiffness will be added to the whole structure, since each panel will act as a slab. The building contains about 6,000 tons of structural steel. The engineers believe that it represents a saving of about 15 per cent over the usual framed floor construction.

ODELL TALKS ON WELDING AT A. S. M. E.

On Friday night, September 28th, Mr. A. G. Odell, director of welding, Denver Public Opportunity School, was guest of honor and speaker of the evening at the meeting of the Colorado A. S. M. E., who held their Fall meeting and banquet at the Adams Hotel, Denver. Mr. Odell spoke of the engineering phases of welding and pointed out the metallurgical problems as well as the practical problems which were involved in successful welding operations. The lecture also showed that welding is a successful method of joining metals whenever it is put in the hands of a competent operator and applied in accordance with any engineering principles.

PROJECTION WELDING OF THICK SECTIONS

Projection welding has marked advantages for some types of metal assembling of relative small size. It gives an opportunity to put all pieces together at a very high rate of speed and with remarkable precision; it reduces the current cost per weld; it makes possible the welding of heavier gauge and thinner gauge without mutilation of the metals; and it makes clean welds without oxidation or indentation of the metals. Sometimes, however, there is an apparent difficulty in the way of using the projection welding method because it looks like an expensive proposition to get the necessary projections in thick pieces of metal, particularly if the metal happens to be a comparatively hard alloy. Mr. G. N. Sieger, Vice President of Elkon, Inc., Weehawken, N. J., who has made a consider-



able study of projection welding has called attention to the fact that these projections need not necessarily be very large or contain a very appreciable amount of metal. It is necessary only to secure a separation between the surfaces being welded and small contact points which will guarantee the concentration of heat between the surfaces to be welded instead of between the metal welded and the electrode surface. He points out that sufficient projection can be secured by bumping the edges of the thick piece at three or four points so as to turn them up slightly. (The accompanying illustration is a greatly enlarged sketch of the result produced.) The squeezing or bumping can be done either by hand or by machinery depending upon circumstances, but it is preferable to have it done by machinery so that the projections will be uniform. This is particularly important in the case of work where it is essential that all the welds have equal strength. The idea will undoubtedly prove useful in a number of shops where it has been assumed in connection with projection welding that it is necessary to have the projection in the center of the pieces to be joined. Projections of this nature are of course not suitable for heavy sections such as boiler plates. They serve for pieces where the actual strength requirements are low, such as in adding machines and typewriters.

REDUCING WORKS MAINTENANCE AND DISTRIBUTION COSTS IN THE GAS INDUSTRY

There are two general fields for application of the welding and cutting process in the gas industry; the first exists in the operation and maintenance of the gas works; the second in the distribution systems whereby gas is delivered to customers.

It is the purpose of this article to indicate briefly but specifically some of the many ways in which the oxy-acetylene process can be profitably applied in the manufactured gas industry.

Every gas works should have a complete welding and cutting outfit as part of the shop equipment, and one or more competent welders on the works pay-roll. The cost of routine maintenance and repairs can be substantially reduced by the intelligent use of welding and cutting blowpipes. Innumerable cast iron and steel parts including large

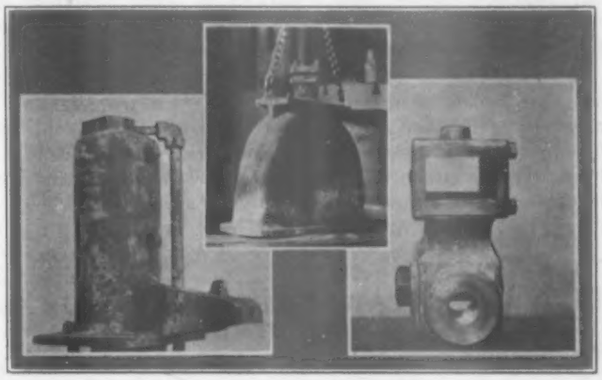


Fig. 1—Left: Flow Meter Cast Iron Welded. Center: Blast Gate Valve Bonnet. Right: Threads Renewed and Face Built Up in Hoisting Engine Crosshead.

castings, which so often are scrapped, can be recovered, and in many instances oxy-acetylene welded right in place in the machine at a very small fraction of the original installation cost. In the emergency job, welding and cutting equipment in the hands of a competent man can do work in minutes which would necessitate delays of weeks if new repair parts were not available.

In order to keep the gas retorts or generators continually supplied with coal or coke, mechanical handling equipment of various types is used. This includes such items as locomotive cranes, bucket elevators, hoists and belt conveyors, all of which are subject to severe service conditions. This is particularly true in handling coke as it is very abrasive.

Such abrasive action can frequently be overcome by applying a coating of Stellite, a wear-resisting alloy, on the surfaces subject to wear. Stellite is easily applied by using the welding blowpipe. A typical example is the Stelliting of a set of revolving grizzly rolls used for separating coke breeze. These rolls were found to have a much longer life than the expensive alloy steel rolls previously used.

The method used to repair gears and gear teeth is simple and thorough. The gear shown in Fig. 7 is from a coal conveyor. Several teeth had been broken out and part of the lips of the flanges were broken off. The welder shaped two small molds of a carbon block (Fig. 6) to fit the gaps between the teeth. The broken flanges were welded and the teeth were built up with cast iron rod to fill the space between the molds. It is also possible to make a similar repair by building up the teeth with bronze welding rod. Manganese bronze, noted for its toughness and long wearing qualities, is often used for gear teeth or wearing surfaces.

In Fig. 1 is seen the bonnet of a 24-inch blast gate valve which had the corner of the flange and a section of the body of the bonnet broken off. Cast iron welding was the solution of the problem; the bonnet is now as good as new. The new guide strip was bronze-welded to the main body under the difficulties of cramped quarters.

Valve stems are often broken or corroded so that they are beyond repair by any method other than oxy-acetylene welding.

At one gas works the cast iron stuffing box on a hydraulic elevator used in the purifier house was badly shattered. Welding offered a novel solution of this problem. Instead of repairing the original casting, it was suggested that the welding shop could easily fabricate a new and better stuffing box from standard steel pipe. This would have the decided advantage of giving additional strength at the point of support, for the entire weight of the elevator was carried on the stuffing box flange. The outer casing of the hydraulic chamber was 14-in. in diameter by about 27 ft. long; the hollow steel plunger was 12 in. in outside diameter.

A section of 15-in. steel pipe was cut to form the body of the stuffing box. To the inside of this a steel ring about 1 in. square was welded, forming a packing ring similar to that

Fig. 2—Welding on Reinforcing Band.

shown in the casting. This ring was welded from both sides and the upper surface was machined with a slight bevel toward the center. A steel flange was welded to the upper end of the pipe section, and a 4-in. nipple 10 in. long was welded into an opening cut in the pipe wall below the packing ring.

As the stuffing box had to slip over the end of the casing, it was necessary to use a lap weld in joining them. It was not possible to weld the joint from the inside as well, for the plunger was still in the casing and its removal would have been difficult. Accordingly it was decided to reinforce the joint by welding on a band, which was to be welded to the stuffing box and to the casting proper.

Two strips of steel plate bent in semi-circles formed the band. After placing one-half of the band in position across the weld, it was welded first to the stuffing box. The other edge of the band was heated with the blowpipe and hammered into contact with the casing, which was of smaller diameter than the stuffing box. After welding this seam the other half of the band was cut to fit, and was welded according to the same procedure.

Immediately upon completion of the weld, the stuffing box was packed and hydrostatic pressure of 125 lb. per sq. in. was applied. All welds were perfectly tight.

Gas companies have long realized the desirability of permanently leakproof piping throughout their works. Welded plant piping has been found to be the solution of this problem. Piping of any metal can be joined by means of the oxy-acetylene process. In gas works the many different piping lines necessary for the proper handling of manufactured products and materials used in the manufacture are welded. When making an alteration on a 12-in. cast iron pipe which was used on a water pump line for a condenser, the flanged section of pipe was found to have been measured and cut too long for use. The oxy-acetylene blowpipe was used to cut off the extra length of the cast iron pipe and the flange was rewelded on with cast iron. The pump is in operation every day and there is no sign of leak or strain of any sort.

Fig. 3—Offset Bend in 50-In. Main.

It would be unwise to conclude any discussion on welding in gas works without a brief consideration of safety. Gas forms an explosive mixture with air. Most plants have rigid rules about open flames and drastically restrict them to proper parts of the plant. The adoption of welded joints eliminates gas leakage almost entirely. Care should be taken, however, that no welding is performed on any container which might contain gas or vapors until after the vessel has been thoroughly purged. If possible welding should be performed with the vessel filled with water. In this way no pocket of gas which might possibly ignite will be left. This point cannot be too strongly stressed. The welder and his superior should know what they are about and should take every precaution before undertaking any kind of welding work.

Welding is already being extensively used by gas distribution engineers. Absolute freedom from leakage throughout the life of the line, ease and economy of construction, and flexibility and adaptability to any conditions of installation, are some of the many advantages offered. The general principles underlying welded pipe line construction have been stated in previous issues.

Installation of gas distribution systems is not, however, exactly parallel to overland pipe line work. Being laid chiefly in localities more or less built up, there are fewer opportunities for straight-away construction. Bends, turns, street crossings, interfering pipes and conduits, traffic congestion—these are some of the obstacles that are met; but no matter what the difficulties may be, welding offers a better, more economical solution than any othr method of construction.

Gas companies are constantly faced with the need for special fittings in distribution systems either during construction or during changes that must be made subsequently. With welding, costly specials are entirely eliminated, as any one, no matter how complicated or unusual, can be fabricated from standard pipe or plate in the shop or on the job.

In many gas works, the distribution department has its own welding shop. Here many standard parts such as drips can be made under shop conditions and sent out all ready to be welded into the mains. (*Oxy-Acetylene Tips*).

McKIBBEN WILL LECTURE ON WELDED BUILDINGS

A lecture tour covering a large part of the United States is soon to be made by Professor Frank P. McKibben, well known consulting structural and bridge engineer, in response to invitations from various societies throughout the country. The lectures, during the winter months, will be on the application of electric arc welding to the noiseless construction of buildings, based on the experience of the General Electric Company and other pioneers in this field. The General Electric Company has already erected one large building and a few smaller ones by this method, and a number of other structures are now being welded by other companies. The itinerary as outlined to date contemplates nearly forty lectures.

The schedule is not yet completed and many of the dates are approximate or tentative. His talk, "Electric Welding of Steel Buildings and Bridges," takes about an hour for delivery, and a discussion of from one to two hours usually follows. The lecture is illustrated with the stereopticon and with blackboard sketches.

DENVER EDUCATOR REPORTS VALUE OF WELDING INSTRUCTION

The value of training men who are to become welding operators or possibly supervisors of welding operations is brought out strongly in a report of the proceedings of the welding section at the annual convention of the Western Industrial Educational Association, held at the Cosmopolitan Hotel, Denver, Colo., May 4th and 5th, 1928. Mr. A. G. Odell, instructor of welding in the Opportunity School, Denver, contributed generously to the discussion. The work of the welding department in the Opportunity School is known to be based upon a desire to give students a knowledge, not only of welding operations, but also of the fundamental sciences which are necessary to provide a thorough background of understanding the process. The discussion brought out the fact that all of the metal working industries are in great need of men who are properly trained and that employers need to be continually reminded that they can profit by having their men properly prepared for the work they do. In fact, it is easier to interest the average boy in the study of welding than it is to convince the average employer that systematic instruction is not only worth while, but necessary. The experience of many students of the Opportunity School has shown that welders after completing the whole course of instruction offered at that school have risen rapidly in the ranks of workmen to positions of responsibility. The discussion pointed to the need for instruction in chemistry and metallury and the advantages to the students of studying these subjects in connection with a welding course. It is also pointed out that many wrong impressions exist concerning welding and its possibilities, due to experiences of past years when the processes were in an early stage of development, and due also to irresponsible statements made by poorly informed welders who do not really understand their work. In some industries welding has been studied sufficiently so that it is recognized as an important process. In fact, in the airplane industry it is a process of major importance, welded joints being directly responsibile for the combination of lightness and maximum strength which is characteristic of most of the present-day planes. There is

no general solution which can be recommended for the problem of getting men properly trained. The length of time required in different cases will vary and local conditions will determine whether night work or day work is the most desirable. Consequently a flexible system of welding instruction is recommended in order that the greatest number of industries possible can take advantage of it.

PIPING CONTRACTOR OUTLINES OBSTACLES TO ACCEPTANCE OF WELDING

As a strong advocate of welding for heating and power piping installations, Mr. John H. Zink, vice-president of The Heat and Power Corpn., of Baltimore, declares that lack of coordination and standardization within the ranks of the piping contractors themselves is one of the greatest hindrances in the way of their introducing welding to architects and consulting engineers. The uncertainty in the minds of those who determine the specifications makes it necessary for the contractor to figure the job first as a flanged or screw fitting installation, and then, if the successful bidder, to sell the architect on welding afterwards.

In a recent article in *Domestic Engineering*, Mr. Zink states that although more than fifty per cent of their high and low pressure installations during the past two years have been welded, in less than five per cent of their total welded installations was welding included as an original part of the specifications. This hesitancy of the architects and engineers he attributes to the following reasons:

1—Seldom two or more piping contractors agree as to the scope of work to be included.

2—Considerable difference of opinion as to the merits of the "butt" weld and "V" type weld.

3—Necessity of using forged steel flanges instead of cast iron.

4—Inability to state with confidence whether the specification for low pressure installations is applicable to high pressure installations.

5—Is welding cheaper?

6—Should the welding be done by the oxy-acteylene or electric process.

Mr. Zink adds that, while his company has found a satisfactory answer to all of these questions, the engineers are still asking, "If you contractors can't agree on what constitutes a welding installation, how do you expect us consulting engineers to specify it intelligently?"

The following case is described to illustrate:

"I have knowledge of a typical high pressure boiler header installation from which high and low pressure branch mains were to run. The consulting engineer specified welding would be permitted according to 'standard practice,' with the added precaution that each bidder must specify in detail in his proposal the piping he intended to weld. My company was one of six bidders with this result:

"Only two of the bidders agreed to weld all piping and weld flanges to the piping.

"Four bidders intended to weld the pipe and branch outlet connections but proposed to use screw cast iron flanges on valves and where additional flanges were specified for disconnecting purposes.

"Five of the bidders insisted on the 'butt weld' and we stood alone for the 'V' type weld.

"It so happened that the consulting engineer in this instance had before him certified tests of six pipe butt welds, none of them equal to sixty per cent (60%) of the strength of the pipe, and an equal number of 'V' type pipe welds, all of them stronger than the pipe itself. He promptly overruled two objections to the 'V' type weld as applied to cut or short lengths. The contractors stated their pipe was beveled at the mill and frankly admitted they were not equipped to bevel short lengths in the field. This work is easily done by the use of a power drive and die-head equipped with special dies which cut and bevel the pipe in one operation.

"We use forged steel flanges on both low and high pressure piping to permit welding flanged connections. Some of you may insist upon this method as being more expensive and I will agree with you. The consulting engineer does not desire you to weld the piping as a whole and then have you make up flanged connections with screwed flanges, for the reason that you thereby defeat the very purpose for which welding is permitted, i.e., the elimination of threaded connection.

"The question of the cheapness of welding, as against the use of screw and flanged fittings, is decidedly an open question. My personal opinion is that welding as a rule is not cheaper, and in no instance do we recommend it as being cheaper. Our policy is to sell welding on the basis of reduced cost of maintenance and repair, lighter weight, strength, permanency and efficiency. I have succeeded in getting permission to weld a piping installation in a number of instances where I knew beforhand it would be more expensive. The difference in cost, however, was not material, and we were glad to pay for the opportunity to prove the merits of welding to the architect and consulting engineer. We did not, and do not, hesitate to thus contribute to those whose cooperation we must have in order to be successful, knowing that it has invaluable educational value and will bring ample return in time."

BOOK REVIEW

LECTURES ON STEEL AND ITS TREATMENT, by John F. Keller. This very interesting book which was brought out during the past month consists of a series of six lectures, the result of many years of intensive study of the properties of iron and steel. During the past few years these lectures have been given to industrial groups throughout the State of Indiana, as part of the extension services of Purdue University. In the past two years a portion of each year has been spent in presenting these lectures throughout the nation, before groups organized under the auspices of the American Society for Steel Treating and Purdue University.

The six lectures form a very thorough discussion of the subject of steel treating, beginning with the making of steel, and ending with a discussion on the warping, cracking and shrinking of steel. The book is easily read by anyone with an average knowledge of technical terms, and the choice selection of drawings and photographs add greatly to the completeness of the work. It is a book which should be read by all those responsible for the working with and the treating of steel, not only because of its technical information but for its great number of practical suggestions. The price of the book is $3.50 postpaid, obtainable from the American Society for Steel Treaters, 7016 Euclid Ave., Cleveland, Ohio.

C. G. M. A. NEW YORK MEETING AT HOTEL ASTOR ON OCTOBER 18

Arrangements have been made for the October luncheon—meeting of the Compressed Gas Manufacturers' Association—to take place at the Hotel Astor, New York City, at 12:30 P. M. on Thursday, October 18. The luncheon will be followed by the regular October meeting of the Executive Board. This meeting gives all members the opportunity of meeting with the Executive Board, and it is suggested that they take advantage of the privilege, bringing with them any subject they may desire to discuss.

APPLIED X-RAYS AND ITS FUTURE POSSIBILITIES

By H. R. Isenburger

At the present time it is of the greatest importance that the general public should be induced to take the most active interest in all scientific development. Science must no longer be regarded as something apart—something of a mystic nature concerned with crucibles and absentminded professors in velvet caps. The intensive development of science will only yield practical advantages when the present deplorable public apathy is replaced by intelligent enquiry and the intimate interest of the whole community.

Not the least important result of the development of X-rays has been that they have formed a common link between other branches of science that hitherto had drifted in something approaching independent existences. By the use of X-rays we have been brought to a more defined realization of the essentially physical nature of our bodies. The discovery that these new rays had very definite action on physiological tissue led to enquiry as to the nature of the changes they produced. It was at once apparent that parallel phenomena could be produced in the laboratory of the physicist. The fact that in all probability our bodies were but special differentiations and arrangements of electrical charges became much more tangible and appreciable than it had been hitherto. Thus, X-rays have proved a most valuable stimulus in the development of that particular line of scientific activity which we call biological physics.

In the domain of chemistry, too, X-rays have had a most important influence. They have been instrumental in emphasizing the fundamental electrical nature of the elements and of the manner in which they combine with each other.

In mechanical engineering the value of X-rays is just on the threshold of its career of usefulness. Many of the problems which confront the metallurgist have resisted and exhausted all known methods of attack. Problems concerning the exact nature of the structural modifications produced in metals by heat and other treatment are to a very considerable extent still unsolved. In addition there is the more practical application of radiography in the service of the mechanical engineer.

The application of X-rays in searching for flaws and defects in engineering materials has already been successfully employed. The fact that the interior of solid structures can be examined without cutting them up has a very high potential value. One of the greatest difficulties encountered in modern engineering is the weakness of materials. X-ray technique has developed enormously during the last few years, and there is definite reason for believing that further progress is possible. The cost of engineering work on castings is very considerable, and as the casting or forging is larger the cost of subsequent machining work increases by a very large factor. The fact that the radiologist can demonstrate cracks and holes in castings is not enough for the engineer. He wants to be told what the flaws mean. The problem is not difficult, but it must be developed into something very simple and definite before it can be used in factory routine without specialized assistance.

The fact that X-rays can be used to examine metallic welds without damaging the specimen seems to promise a very wide sphere of useful activity. It is certain that if a reliable method of determining the soundness of a weld could be used, then welding would be adopted to a much larger extent than it is at present. This is particularly true of shipbuilding, where riveting is now so widely employed. The possibility of using X-rays to examine ship welds IN SITU has been considered, and the problem seems to be capable of solution. It will be necessary to design and construct X-ray plant of great power capable of being slung over the side of a ship. The design of such equipment is a matter of great difficulty, but nevertheless this particular application of X-rays has such importance that it warrants the devotion of care and time to a consideration of the problem.

From the point of view of medical treatment by X-rays and also the radiography of heavy metal castings, we must have X-ray tubes that will work at extremely high voltages, certainly up to half a million volts. The construction of such tubes is a matter of great difficulty, and physical problems are involved which demand a very high degree of skill and experience in their solution. The hot cathode is the key to the high voltage tube we require, and research therefore is primarily concerned with development along these lines.

The question of the provision of electrical generators for X-rays is by no means as acute as the need for better tubes. Transformers have already been constructed to deliver current at voltages far higher than anything we can possibly use for X-rays. The present X-ray problem from this aspect is concerned with the nature of the high tension current supplied to the X-ray tube. Some work has already been done to study the various forms of high tension current that are possible and to examine the quality of X-rays they engender, but very great improvement in X-ray efficiency may be expected, as research in this direction proceeds. A good deal has been written in the last few years against the waste involved in overlapping in scientific research. No doubt the frenzied search for avenues of economy is responsible for a good deal of this criticism. It is a short-sighted policy. In the realm of industry X-rays have yet to be established, and such is the conservatism of modern business that an enormous amount of energy must be expended in explaining obvious applications to sceptical individuals and organizations. The most powerful factor operating against innovation is the old and indisputable fact that "my father did perfectly well without it." This idea, even when not expressed in words, is a convenient mental armchair in which to indulge the inherent laziness that characterizes certain people. The radiologist does not know all the problems of industry. He can only offer his rays as a new tool to the industrialist, and leave it to him to suggest the particular problems in his own sphere which they may help to solve.

BOTH CAST IRON AND BRONZE WELDS PROVE DURABILITY IN SERVICE

A punch press which broke at two different times in two distinct places demonstrates the fact that the two standard methods of oxwelding cast iron are equally sound. The press in question was used for punching out some of the many small metal parts used in radio construction.

At the time of the first break, production in this shop was at a high peak and overloading was responsible for the strain which cracked the frame. Welding proved to be a most opportune solution, for the delay entailed in sending away for a replacement casting would certainly have caused the loss of some orders. A service operator was called in and advised welding the frame with cast iron. This was quickly done and the machine was put back into operation.

Orders kept piling in and again overloading was responsible for a break in the casting. This time the cracks occurred at a point about twenty inches below the cast iron weld. They were so located that the repair could be made by bronze-welding, thus avoiding the necessity of preheating and annealing.

Forty-five degree vees therefore were chipped out on both sides of the punch press frame. Twenty pounds of bronze welding were used on this weld. The total cost of both welds was much less than that of a new casting so that the saving to the firm was considerable. These repairs thoroughly convinced the plant superintendent that his oxy-acetylene equipment was a most profitable investment.

IT PAYS TO FIND OUT

In spite of the best foundry practice and careful inspection, internal defects may remain unnoticed in a large casting. Sometimes such a defect will not give trouble when the casting is put in use, but will develop into a break suddenly, and at the most inopportune time.

This is well illustrated by the experience of a mining com-

pany. A large ball mill developed a crack around the end of the outside shell due to internal defects and gas pockets in the casting. Although the superintendent felt that the break could hardly be welded, he did not wish to overlook any possibility of its reclamation, and accordingly got in touch with his oxygen manufacturer for the assistance of a service man. When the oxy-acetylene service operator arrived in the plant, a crew of eight men was already at work, making preparations to dismantle the ball mill.

After a careful examination the service operator advised the superintendent that it would not be necessary to remove any part of the mill as the fracture could be successfully repaired by bronze-welding the casting right in place.

The break extended for 48 inches along the end of the casting where the metal was 2 inches thick. It was carefully chipped out, forming a vee 2 inches deep and 48 inches long. It required only about 6 hours welding time to add the 40 pounds of bronze necessary to fill up this vee and also to build up a section of the casting that had broken out entirely. No preheating was necessary.

As a new casting would have cost $875 plus about $300 for labor in installing it, there was a saving of over $1,100 on this one job.—*Oxy-Acetylene Tips.*

OXY-ACETYLENE TORCH LOOSENS PIPE FITTINGS

A correspondent to Power Plant Engineering declares that application of the oxy-acetylene torch is no longer a novelty for welding and cutting but the other uses that it can well be put to are limited only by the ingenuity of the engineer.

Recently, he saw some pipe fitters at work making up a 16-in. flanged spool. One of the flanges lacked ½ in. of screwing up far enough. Ordinarily, this would have meant removing the flange and taking it or the pipe to the machine shop to have the threads eased in a lathe. The plan adopted was to heat that part of the pipe inside the flange with two torches for a few minutes, then the pipe was allowed to cool, the cooling being hastened with water.

As a result, the flange, which before could not be moved by three men and a 12-ft. lever, could now be freely turned by hand. It was, therefore, screwed on the required amount and a slight peening insured its tightness.

Heating the pipe caused it to expand but the flange prevented it from increasing its diameter, so it found relief by compressing itself, and when again it became cold it had contracted enough to make the flange loose.

Flanges which are rusted or cemented on can by this means be readily removed. Heating the ends of boiler or other tubes that are tightly expanded in tube plates can, in this manner, be a means for loosening them.

WELDING SPRINGS WITHOUT DESTROYING ELASTICITY

H. C. Ten Horn, who operates a plant at Nijmegen, Holland, engaged in the manufacture of baby carriages and toys, submitted a paper in the Lincoln Prize Contest in which he describes a very interesting set of jigs which has speeded up their production by permitting one welding operator and an assistant to take care of two jigs at a time. A number of these welding tables are illustrated and described in Mr. Ten Horn's paper which appeared in the August 30th issue of *Iron Trade Review.*

One of the principal assemblies is that of the baby carriage axles welded to the springs. When rivets were used each chassis required in addition to springs and axles, four saddles and eight rivets. Inasmuch as the springs are of cold rolled steel and are not hardened, it is apparent welding cannot be employed unless the temperature of the springs can be kept below the critical point. It has proved possible to make the welds without excessive heating of the steel by use of the arc welding method. To determine the degree of heating of the spring steel during the welding operation, experiments were conducted with polished steel samples. It was found that the steel never colored further than purple, which means that it did not lose any of its elasticity.

The assembly is placed in a rotating jib, and the first four welds, all on one side of the axles at the four points of contact, are made, and then the jig is rotated and the corresponding welds made on the opposite side of the axles, the first welds having had time to cool so that their heat will not be added to the adjacent weld.

ALL-WELDED SEAMS MAKE CLEANER FURNACES

A concern manufacturing sheet metal furnaces has found in welding the solution of one of its most perplexing problems —how to keep the heating air clean and free from gas and dirt. The experiments which led to the decision to weld all the seams cover a gradual progression from cast iron furnaces to all-welded sheet steel construction.

The first furnaces made by this firm were of cast iron,

Welded Seams Provide Dust-and Gas-Tightness Not Possible With Bolted and Riveted Construction

built up one section above another like a bookcase. The joints between the castings were filled with stove putty or furnace cement. When this type of furnace had been in service for a while this cement baked out of the joints and complaints began to come in of gas and dust leakage. In an effort to eliminate this, the next model was designed with a riveted steel dome which worked well until the expansion and contraction caused by the heat of the furnace pulled out or sheared the rivet heads. making the second model nearly as leaky as the first. Even when a third model was tried with two rows of rivets, the trouble was not completely overcome.

Then a furnace was designed with a welded combustion dome. This construction has eliminated all complaints based on leakage of gas and dust.

Welding is done on the dome seams, the feed and ash chutes, the radiator and collar, and ash pit bottom. In addition to the firebox proper which holds the grates, there is an air chamber in which is a radiator. This receives the cold air from the outside and distributes the warm air to the outlets within the residence.

After welding the assembly of the coal chute and the ash chute to the furnace front, the chutes are attached to the body of the furnace. For this purpose a jig is used which consists of a wooden framework shaped to fit the furnace sides. The furnace is placed in this jig, and the seams of the ash chutes and coal chutes are welded to the body. During welding the parts are held in alignment with C-clamps. The final touches are given and the fronts of the furnaces are prepared for finishing. Eleven welders are kept busy all the time. Oxygen is supplied from manifolded cylinders, and acetylene is piped through the shop from a low-pressure generator to the various places where the work is being done.

Experience has proved that seamless, welded steel construction is the most durable that can be used, and that the only furnace which is permanently gas-tight is one made from welded steel, without any cast iron joints at all. Representatives of this manufacturer claim that welded furnaces give a much cleaner heat, last considerably longer, and consume less fuel than any furnace of equal grate area. Such is the company's belief in welding done under proper conditions that they guarantee the steel parts and joints unconditionally for ten years.—*Oxy-Acetylene Tips.*

WATERTUBE BOILERS FABRICATED FROM STEEL PLATES

In the July 12 issue of "Iron Trade Review" is described one of the first applications of steel watertube boilers to domestic heating purposes, recently developed by Orr & Sembower, Inc., Reading, Pa. These units now are being sold for use in residences, apartment buildings, churches, banks and other public buildings.

Impressive reasons are advanced by the manufacturers as to why they regard steel as a superior metal for heating boilers. A steel boiler is made in one piece by welding, thus eliminating the necessity for assembling sections as with sectional boilers. There are no joints to increase the danger of leakage. The use of steel makes it easy to employ the watertube principle. The water tubes are of copper, which conduct heat to the water about three times as fast as steel The copper tubes are expanded into place in the tube sheets at the front and back of the boiler.

The design of the combustion chamber which is possible in making steel boilers in one piece, the use of copper watertubes which are set at an angle from the horizontal, thus hastening the rate of circulation of the water, and the use of steel baffle plates which cause the heated gases to travel back and forth at least three times the length of the firebox, all conribute to marked efficiency in fuel consumption. Tests of the boilers showed them to be 77 per cent efficient on coal anl 83 per cent on oil and gas, figures far in excess of those that are customary with average house heating boilers.

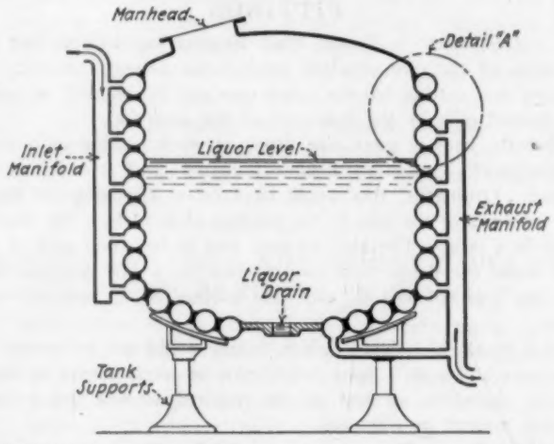
Electric arc welding is employed in the manufacture of the boilers. The boiler proper consists of inside and outside shells between which the water circulates. The inner and outer shells are formed by bonding $\frac{5}{16}$-inch plates; then the front and rear heads are welded in place. There are a number of openings. Two of these, one in the front head and one in the rear head, afford easy access to the copper watertubes, and are covered by pressed steel plates, each of which is held in place by ¾-inch studs. The other openings, including a fire box door, the flue in the rear and a cleanout door on each side, extend through both the outer and inner walls of the boiler. To seal the waterlegs at these openings, narrow pieces of boiler plate are bent into the proper form and welded in place.

Steel is employed in numerous other ways in the boilers. Steel staybolts, ¾-inch in diameter, hold the inner and outer shells together, and after the boiler joints have been welded these staybolts are welded permanently in place. The openings which make the boiler tubes accessible are reinforced by ¾ by 2-inch bars which are welded to the head of the boiler around the opening on the inside. The base of the boiler is made of 12 or 14-inch channels, depending on the size. For regulating the damper there is a ¼-inch round rod which passes through a length of ¼-inch steel pipe welded to the side of the boiler. The flue opening at the rear is fitted with a flanged collar made of steel plate and welded in place. All doors, handles, grates and the grate operating device are castings.

WELDING JACKETED PRESSURE VESSELS

To overcome the difficulties invariably experienced with all previous designs of jacketed pressure vessels, whether of riveted, stay-bolted, or cast construction, T. K. Lowery and W. H. Eichelman have developed a vessel which is of simple construction, eliminates leakage and is efficient in the transmission of heat to or from the liquids in the vessel. This design is described in the August issue of *The Boilermaker.*

The chief weakness in jacketed vessels had been the loos-



Sectional View of Pasteurizer Built Up of Spiral Coil Pipe and Welded.

ening of the stay bolts and rivets due to the extremes of temperature from alternate heating and cooling of the contents. This trouble had been obviated in one design in which the tubes were imbedded in the heavy wall of the cast vessel itself. The thickness of wall however, offered considerable resistance to the transfer of heat.

At once the simplest and most efficient design is that illustrated in the drawing, which shows a spiral coil constructed so that the continuous helices lie in juxta-position with one another, and these adjacent members joined by welding so as to form in themselves a continuous wall.

This construction permits of the use of relatively thin gage material. It eliminates the necessity of using reinforcing members which have universally been used to afford the strength necessary to resist both the bursting and collapsing pressures to which such a structure is subjected. It also augments the transmission and absorption of heat. Such a construction readily permits of vast variations, both as to its general outline and to its internal and external dimensions.

One machine is described, which was designed originally as a milk pasteurizer, but was later torn down and rebuilt to various designs. Sections of the welded tubing have been subjected to tests endeavoring to destroy the weld, and have even been put under a drop hammer until the tubing was literally destroyed, but the welds still held.

MANY EXHIBITS ALREADY PLANNED FOR NEW YORK POWER SHOW

One of the greatest annual events of Industry and Engineering Practice which is awaited anxiously by manufacturers of industrial equipment and kindred products is the Seventh National Exposition of Power & Mechanical Engineering at the Grand Central Palace, New York, December 3-8, 1928. It provides industry and engineers an opportunity for comparison of similar products and is the means of increasing old business and adding new customers, which is of vital importance to all industry. Purchasers and executives attending are able to establish and visualize the types, keeping abreast of recent developments in engineering practice.

It is surprising to note how many exhibitors are represented in different sections under the various classifications; these are at the present writing:

Power

25 Exhibits of Instruments of Precision
54 Exhibits of Electrical Equipment
18 Exhibits of Pipe and Piping
49 Exhibits of Valves and Fittings
24 Exhibits of Steam Specialties
10 Exhibits of Pumps
19 Exhibits of Engines and Turbines
3 Exhibits of Coal Companies
10 Exhibits of Pulverized Coal Equipment
6 Exhibits of Oil Burning Equipment
14 Exhibits of Stokers and Grates
12 Exhibits of Boiler Makers
8 Exhibits of Feed Water Heaters
5 Exhibits of Feed Water Softeners, etc.
20 Exhibits of Fire Brick, Arches, etc.

Heating and Ventilating

10 Exhibits of Radiators
4 Exhibits of Cooling Towers
20 Exhibits of Blowers
5 Exhibits of Air Conditioners
6 Exhibits of Air Filters
9 Exhibits of Gaskets and Packing
9 Exhibits of Separators
15 Exhibits of Furnaces
12 Exhibits of Boilers
14 Exhibits of Grates and Stokers

Tools

46 Exhibits of Tools and Machine Tools
7 Exhibits of Lubricants
11 Exhibits of Lubricators

Transmission Equipment

5 Exhibits of Belting
3 Exhibits of Belt Dressing
3 Exhibits of Belt Fasteners
3 Exhibits of Belt Chain
7 Exhibits of Pulleys
6 Exhibits of Drives
3 Exhibits of Transmissions
6 Exhibits of Clutches
14 Exhibits of Bearings
15 Exhibits of Gears
18 Exhibits of Couplings
7 Exhibits of Speed Reducers

Miscellaneous Group—Includes

14 Exhibits of Safety Appliances

Numerous exhibits of material handling equipment, insurance firms which specialize in boiler and plant insurance and many other interesting exhibits.

This tabulation indicates the scope and support the manufacturers lend yearly to this great central display in the Power and Mechanical Equipment field. Engineers attending the annual meeting of the A. S. M. E. spend much time inspecting and comparing various types of equipment adapted to their own particular industry. The registration of executives and buying officials increases each year and from all parts of the world come requests for information on various types of equipment exhibited. Every industry is directly interested in some form of mechanical appliance that will be shown at the Seventh National Power Show.

STRENGTH TESTING OF WELDS

By F. G. Tatnall*

The real proof of the weld is its ability to stand up under service for the life of a structure. When it is unsafe to try it out in service, or when it is inconvenient to wait many years to see if the weld proves itself good, then recourse must be had to the testing machine.

There are small, light machines for transporting to the site

Emery Laboratory Tester for Sample Welds.

of the work and obtaining a rough check on the strength of the weld. Next in line is the laboratory machine where an accurate study of the sample weld to destruction is made. Finally there is the test of the full-size welded structure where the structure is either compressed or pulled in tension to destruction.

The smaller machine illustrates the laboratory tester for sample welds, and the larger machine is used for full size structures either in tension, compression, or transverse loading. Both machine are Emery Testing Machines built by the Southwark Foundry & Machine Company of Philadelphia and are designed to make tests in the simplest manner with the greatest accuracy. Both are hydraulic machines containing the Emery weighing system, which itself is hydraulic, but entirely separate from the power cylinders, so that friction in the power

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*Southwark Foundry and Machine Co.

cylinders will not interfere with the very precise load indications.

Hydraulic machines are used because they are the simplest possible devices for the work in hand and offer the maximum convenience for setting up specimens and in obtaining delicate speed control. They also work in comparative silence and with least mechanical confusion. A hydraulic machine can be designed without becoming awkward or massive so that it will allow the greatest working space in the machine. For instance,

Emery Testing Machine for Testing Full Size Structures in Tension, Compression, or Transverse Loading.

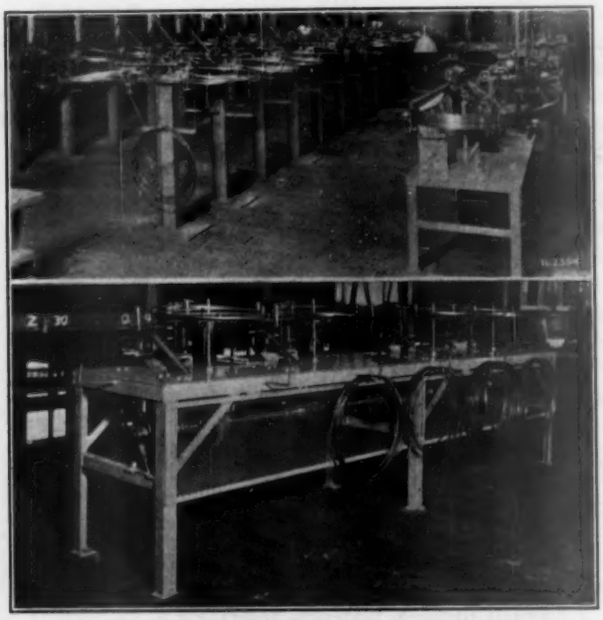
in the small machine which weighs only 2200 lbs., although it has a pulling capacity of 60,000 lbs., there are no obstructions on three sides of the specimen. In the large machine whose capacity is 1,000,000 lbs., there is a clear distance between the two uprights of seven feet and both tension and compression testing is carried out on the steel table built into the floor. The operating cabinet is at a distance from the machine, and because of the absence of machinery and mechanism, one cannot tell when the machine is actually working unless he reads the dials in the cabinet. The machine exerts its forces by the vertical sliding of the two columns in the bearings built into the table.

ALL WELDED SHOP EQUIPMENT

When installing some new machinery in their shops recently, the Westinghouse Electric Company resorted to all welded fabrication of the necessary tables and supports. The accompanying photographs show in fair detail the type of work done and the location of the welds made. As may be seen, the entire layout was assembled from standard steel shapes, such as I-beams, angle iron, trap iron, cold rolled steel, ordinary pipe, and sheet steel.

The compactness and neatness of the equipment attracts one's attention immediately, and the simplicity of design, which could have been obtained only through the use of the welding process, is particularly noticeable. At the same time one knows that these various machine supports will prove just as satisfactory and even more stable than anything which could have been constructed by the old bolt and nut methods.

The welding process as used there obviously suggests the great advantages to be gained through its use in any manufacturing plant. The shop manager who has new equipment



Neat, Compact Equipment Economically Constructed by Welding.

to install may often, as in this case, find it necessary to fabricate his own stands and tables. Through the use of the welding and cutting outfits, which are available in both the the production and repair departments of most plants, he can construct to suit his own particular needs the required supports. The flexibility of this process makes it especially applicable to this type of work, as every shop has its individual problems, and especially welded parts can often solve them.

SPELTER MIXTURE INCREASES STRENGTH OF WELDED SEAMS IN COPPER

Manufacturers of copper tanks will be interested in a welding method which has recently been adopted by one shop and promises to have a considerable influence on the success of their production work. On account of the necessity for tight joints a number of different ways have been tried and a number of different materials without in any case producing the desired result. The latest method adopted consists in using the carbon arc as a source of heat and a mixture of brass spelter with boric acid powder for filler material. The two components of the mixture are made up into paste with water and applied to a seam in copper, brass or bronze tanks. When the arc is drawn over the seam the zinc content in the spelter serves to deoxidize the air which is in contact with the molten metal and the boric acid serves as an additional protection to the metal. So much of the zinc is volatilized that the deposit strongly resembles pure copper. The welds thus made have a clean sound appearance and in one shop where this procedure has been followed, a 100 per cent increase in the strength of the joint was noted. This improvement in results suggests the possibility of using brass spelter in a number of cases where difficulties are encountered in the welding of copper and its alloys.

NEW DESIGN OF ARC WELDED CRANE

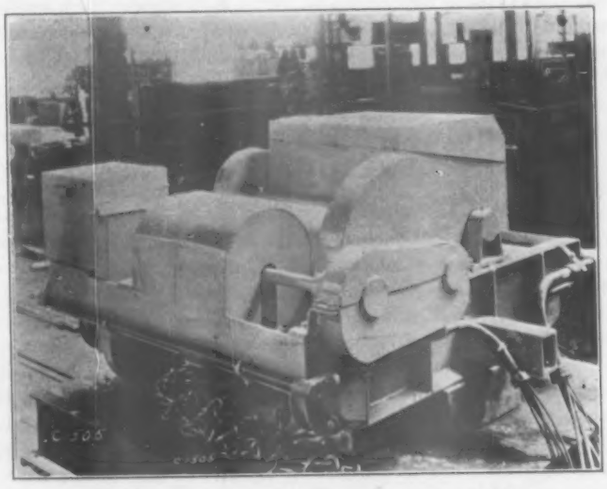
The Cleveland Crane and Engineering Company, Wickliffe, Ohio, announces a new design of overhead traveling crane in which the bridge girders, end trucks and trolley are constructed by arc welding.

The illustration reproduced herewith shows a 5 ton 38′ 9¼″ span crane of the I-beam girder type. Each girder is reinforced

5-ton, 38-foot Span Crane.

throughout its entire length by angles arc welded to the standard I-beam sections. Riveted girders of similar construction would employ a channel section instead of the two angles. However, this extra material would not give as great strength or rigidity.

The girders are attached to the end trucks by the notched or shoulder construction designed to prevent weaving. To facilitate shipping the girders and trucks are disassembled. The field con-



Trolley with Arc Welded Frame and Gear Guards.

nection is made by bolts but additional arc welded reinforcement is recommended to secure maximum rigidity.

The end trucks themselves are built up of two standard channel sections joined by arc welding. Roller bearings are used on this crane permitting rapid acceleration and lower power consumption.

Two small standard arc welded trolleys are illustrated. Each trolley frame is made of a standard channel with arc welded braces under each bearing point. Gear guards are arc welded as is also the hand rail on the foot bridge and the bearing supports for the bridge drive shafts.

All welding on this crane was done by machines furnished by The Lincoln Electric Company, Cleveland, Ohio.

The advantage claimed for arc welded crane construction, other than greater rigidity and strength, is that a more efficient distribution of weight is possible, thus making it possible to lighten certan moving parts and thereby to obtain greater acceleration.

PRESS BRAKE REPAIRED BY ARC WELDING SAVING $2,000

R. B. Havens describes this interesting repair in *American Machinist*. A breakdown recently occurred in one of our main production machines—a 10-gage press brake. The machine had been worked to over capacity and the crown section cracked as a result. The crack was a serious one and they were faced with the necessity of purchasing a new machine.

A few months previously, a small General Electric arc-welding set had been purchased, and it was decided to attempt to repair the broken machine by arc welding. The three longitudinal sections of the machine—the crown, punch and bed sections—were cut out and new longitudinal sections were fabricated from steel channels, angle plates and pipe. Using the newly fabricated sections in place of the old cast sections, the machine was repaired and reassembled and was soon ready for work.

The original machine was 10 ft. wide, but the rebuilt machine was but 6 ft. wide, this width being considered better suited to our requirements.

A new machine would have cost in the neighborhood of $2,000 or $2,500, while the cost of rebuilding the old machine by welding was but $550, including a new shaft, which was one of the principal items of expense and one not chargeable to the welding.

FRICTION AND NOISE NUISANCE ELIMINATED

Welding as a method of eliminating a noise and friction nuisance may seem rather strange, but that is exactly what was used effectively at a lumber camp on the west coast.

A conveyor consisted of two steel chutes through which ran steel conveyor blades, made up in two sections bolted to a continuous cable. On the upward trip one edge of the blade scraped along the chute and the other edge scraped on the way down, so that almost the same friction and wear came on each edge. The steel edges of the flights rubbing along the chutes made a great deal of harsh noise. Wear of the blades was another important consideration.

It was suggested that since bronze makes such a good bearing surface and can be easily applied with the oxy-acetylene blowpipe, this method should be used to build up the surface of the worn conveyor blades. Each edge of the flight was given a new surface of bronze. With the re-edged blades, the work went on with a minimum of noise. At the same time the size of the junkheap, where formerly the conveyor blades had been thrown, dwindled rapidly. Bronze-welding for such reclamation work is being used more every day. (*Oxy-Acetylene Tips.*)

AN EASILY CONSTRUCTED HEATER FOR ACETYLENE GENERATORS

The following description of an effective means of preventing generator freeze-ups appeared in "Sparks," issued by Kentucky Oxygen-Hydrogen Company:

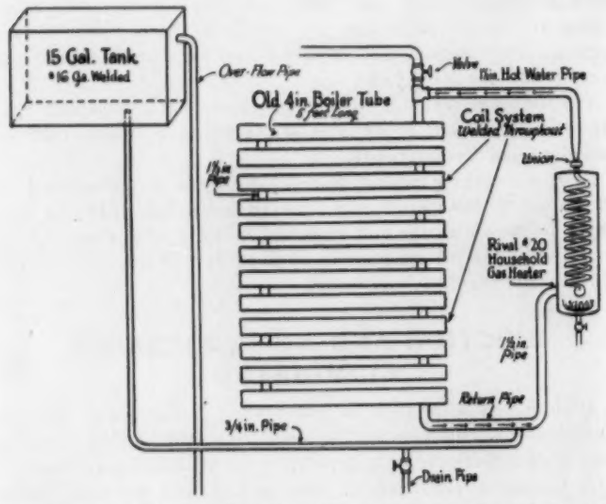
Those who operate acetylene generators in localities where the temperature gets down below the freezing point in winter will be interested in a heating system which will relieve them from worry and also save the time ordinarily spent in draining the machine at night to prevent freezing and in recharging the generator the following morning.

Both the Underwriters' Laboratories, Inc., and ordinary

safety require that outside generator houses, when heated at all, be heated by what is termed an indirect source of heat. Steam or hot water circulating systems provide the proper sort of heat and when the plant or shop is heated by either of these methods, it is a simple matter to extend the steam or hot water line to the generator house.

A large number of plants and shops, however, are not provided with such facilities for heating. In other cases, even though suitable plant heating systems are installed and in use during the day, it is not practical to keep the temperature of one particular room, such as a generator house, up to the proper safe temperature during extremely cold weather. In such cases an independent and indirect source of heat is advisable.

The system described was designed and installed by Greathouse Brothers & Company, sheet metal workers, Louisville, Kentucky. Its principal features according to Mr. Joe Greathouse, are: low initial cost, low operating cost, and absolute reliability.



Diagrammatic sketch showing ingenious independent heating system designed to prevent freezing up of generator in cold weather.

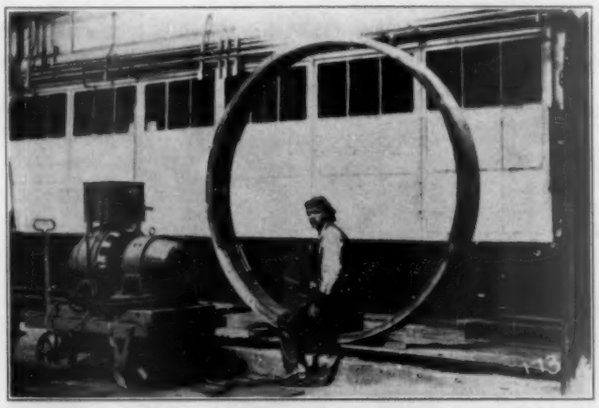
The essential items, as shown in the diagram, consist of an ordinary household, copper-coil heater with gas burner, a welded "balance tank" of fifteen gallons capacity, twelve 4-inch boiler tubes five feet long for the necessary radiating surface. together with the necessary piping and fittings to install. Old or secondhand material was used for the most part and this particular installation was made at a total cost of a little less than $32.00, including labor. Their generator house is of wood construction, 6 x 6 x 10 feet high, lined with asbestos paper and is located seven feet from their main shop. The gas heater is just inside the main building. The gas flame is adjusted by hand according to weather conditions and thus its operating cost is almost insignificant.

It is essential for the proper operation of the system that air be entirely eliminated. This is accomplished by "cracking" the union just above the heater and forcing the water through the circulating system, first in one direction and then in the other, until no more bubbles can be seen in the escaping water.

RECLAIMING A BRAKE RIM BY ARC-WELDING

A new use for arc welding has been found in the reclaimation of large steel pieces wich are not perfect as they come to the shop. Many pieces that would otherwise be scrapped are now reclaimed at the shops of the Westinghouse Electric and Manufacturing Company by the use of the electric arc.

In reclaiming the brake rim shown in the accompanying photograph a low carbon steel filler rod was used. The piece was built up ¼ inch around the inner rim, the filling was carried back from the edge for about two inches. The rim



Rejections Are a Source of Loss That Can Be Reduced by Welding the Defects.

was then machined in the usual manner, and since the difference in the carbon contents of the steel and the filler was so slight, no difficulty was met with in this operation. Neither was any line of demarcation found in the finished piece.

DOUBLE-DISHED HEADS FOR WELDED TANKS

A new design in tank heads has been developed by the Commercial Shearing and Stamping Company, Yougstown, Ohio. The chief feature of these heads is that the slightly flaring flange extends in the same direction as the bulge of head so that when pushed into the shell it tightens up around the entire circumference. The metal to metal contact makes an ideal welding condition. The bulge in the head more than compensates in capacity for the length of the shell required for the flange.

ELECTRIC ARC CUTTING AND WELDING COMPANY DEVELOPS POLYPHASE A. C. WELDER

The Electric Arc Cutting and Welding Company, who are well known for their work in the commercial development of alternating current arc welding in this country, have now produced a polyphase transformer arc welder. The new transformer which consists of a T-connected primary and double secondaries, will take any single phase load even at low power factor, and distribute it amongst the two or three phases of the polyphase power supply. With this scheme there is no loss of efficiency except to supply a slightly increased core-loss, and there is no equalization current or any of the usual surging towards one phase. The designers claim that the three phase transformer balances perfectly with two arcs operating, and with one arc operating, a balance for either current is never more than a ratio of two to one. It is this distribution of a single phase load on a polyphase power supply that distinguishes the new welder from previous designs.

This company has also built a new type of gas-electric drive welding car, for railway use either alone or with trailers, which can provide both direct and alternating welding current. This car is light enough to be used on main traffic lines. It can be quickly jacked up, and a revolving portable turn table allows the entire outfit to be removed from the track in any direction with a minimum of delay.

PHOENIX ACETYLENE PRODUCTS PLANT CELEBRATES SECOND BIRTHDAY

An apparently very successful practice was established when the Phoenix plant of the Acetylene Products Company of El Paso, Texas, invited all representatives of the oxy-acetylene trades in their district to attend a second birthday celebration on the night of September fifth. Nearly 200 representatives gathered at the offices of the organization and were entertained by a very instructive and interesting program.

200 Enjoyed the Instructive Entertainment at Acetylene Product Company's Second Birthday Celebration.

A tour of the plant was first made by the visitors, and the uses of the various apparatus was explained in detail. A point emphasized was that all construction of storage tanks, pipe lines, and other apparatus was done through the use of oxy-acetylene welding. Even the heavy steel castings of the storage tanks were welded together as well as the pipe connections and the compression machines.

After the tour of the plant was completed, a Gas Products Association film was shown as part of the entertainment, following which the newest types of torches were shown in demonstrating cast iron cutting, extra heavy steel cutting, and extra heavy steel welding.

Then following this entertainment, Mr. W. W. Thornton, secretary and treasurer of the company, gave a short talk in which he traced the rapid development of the acetylene industry since its beginning down to the present time. He traced also the growth of The Acetylene Products Company from its start early in 1919 up to the present time.

The first branch plant of the rapidly growing organization was started early in 1926 in Phoenix and was opened for operation about October 1 of that year. William Miller, who constructed all the equipment of the Phoenix plant through the use of welding methods, was named as manager of the plant there. From the opening of the plant in 1926, the business has grown and expanded year by year.

The closing portion of the program, which featured food, smokes, and a get-together rally, brought forth some extemporaneous entertainment. At this same time three prizes valued at $200.00 were distributed. Each welder had been furnished with a numbered ticket, and three of these were drawn for a first, second, and third prize. The first prize was a complete cutting and welding outfit, the second an L Meco cutting torch, and the third a welding torch. The lucky winners were J. H. Attaway, Ernest A. Duval, and N. Fair, all of Phoenix, Arizona.

This party gave so much satisfaction to all concerned that it is planned to make it an annual affair. If this past meeting is any criterion, it will undoubtedy be a celebration which will be looked forward to by all those connected with the oxy-acteylene welding industry in Arizona.

CENTRAL STEEL & WIRE NOW STOCK AIRCRAFT MATERIALS

The Central Steel & Wire Company in their new bulletin entitled "CESWIC," announce the establishment of a new department in their organization specializing in practically all the metals that go into an airplane. Immediate shipment service of these special metals from all the warehouses of the concern is one of the major objectives of this addition to the organization. Among the products handled by this department are: Special aircraft seamless steel tubing, both Chrome Molybdenum and high carbon, aircraft cold rolled strip steel, round edge flat wire and stranded cable and aircraft wire. Sweedox welding wire and rods for airplane welding are also supplied through the same department. According to the pamphlet their CESWIC aircraft special metals conform to the strict government regulations, and where the question of physical requirements is of vital importance, test reports of their physical properties and chemical composition will be furnished with each shipment. The bulletin also contains data, tables, and specifications of the various special metals carried, along with complete price lists.

THE OXWELD SHAPE-CUTTING MACHINE

An automatic oxy-acetylene shape-cutting machine designed to cut shapes of any sort from steel plate, sheet, forgings, billets or ingots is being introduced by The Linde Air Products Company, 30 East 42nd Street, New York. In this machine the cutting blow pipe is mounted on a carriage which is moved in any direction by means of an electric motor. For routine production it will operate automatically from templets. In cases where only a few parts are to be cut out a hand tracing device can be attached and used to follow the outline of a sketch or blue print.

The parts of the machine are sturdily built without impairing the delicacy of adjustment necessary in a precision instrument of this sort. The rigid construction and unique design prevents lost motion and makes the cutting accurate in every case.

The Oxweld Shape-Cutting Machine requires but one operator. Little machining is necessary in most cases after cutting because the parts are produced with straight corners and smooth faces. The speed of cutting ranges from 3 to 20 in. per minute, depending on the thickness of the metal. Accurate and smooth cuts can be made in stock up to 1 ft. and more in thickness. It is claimed that production costs are reduced sharply owing to economies in labor, time and material.

OXWELD MEDIUM PRESSURE-TYPE ACETYLENE GENERATORS OF IMPROVED DESIGN AND INCREASED CAPACITY

Three medium pressure-type acetylene generators for welding and cutting have been placed on the market by the Oxweld Acetylene Co., 30 E. 42nd Street, New York City. The Type MP-2 Medium Pressure Acetylene Generator, built in two sizes having 50 and 100 lb. carbide capacity respectively, replaces the earlier Medium Pressure Acetylene Generator while the type MP-3, having 300 lb. carbide capacity is entirely new, no pressure-type generator of this size having been manufactured by this company heretofore. These three generators are suitable for supplying pressure-type or medium pressure welding and cutting blowpipes.

Several features of the new design will improve the operation of the generator and further insure its safety. The feed mechanism has been redesigned to make the carbide shut-off even more positive than formerly. A new method is used to stop the carbide feed positively in case the diaphragm breaks or zero pressure exists in the generator due to any other cause.

A new regulator, the Type R-40, is furnished instead of the line regulator formerly used. This regulator is of the stem type, having a large stem and seat to provide ample capacity, and is equipped with two gauges. One of these indicates the pressure in the generator and the other the pressure in the delivery line. The hydraulic back pressure valve, which has been simplified, and the filter are of seamless steel tubing assembled by bronze-welding and then galvanized. This construction is more sturdy than that previously employed. The vertical pipe, leading downward to the back pressure valve and extending below the surface of the water, is fitted with an angle check valve. In case back pressure is exerted, water will be forced up the vertical pipe causing the check valve to close and preventing the possibility of back pressure or flash reaching the interior of the generator.

The two relief valves, one mounted on the hydraulic back pressure valve and the other direct-connected to the generator, are of new design, have larger capacity and are less liable to leak than the older devices. A desirable feature consists of interference levers which unseat the relief valves every time the generator is recharged. This arrangement automatically prevents the relief valves from sticking, should they be called upon to function. Since the relief valve on the hydraulic back pressure valve opens only momentarily, no acetylene from the line is lost during recharging. A conveniently placed clean-out door renders the feed mechanism parts accessible and easy to clean without dismantling the generator.

With the more sensitive feed and comparatively close regulation obtained by means of the large-capacity, type R-40 Regulator, a higher constant delivery pressure is available than with the earlier model generator. The relief valve should be set to blow off at a pressure not higher than 15 lbs. per sq. in. Allowing for pressure differential, approximately 11 lbs. will be the maximum delivery pressure.

The type MP-2 generators use ¼x⅜ in. carbide. Shipping weight in the 100-lb. size is 1,100 lbs. and in the 50-lb. size 925 lbs. The former has a diameter of 3 ft. 5 in. and the latter 3 ft. 1 in.

The Type MP-3 Medium Pressure Acetylene Generator has been placed on the market to meet the demand for a pressure-type generator of large capacity that will supply gas with a minimum pressure fluctuation and with minimum expense for maintenance.

The same principle of carbide feed that has proved satisfactory in the popular Oxweld Balance Seal Generator is used in the Type MP-3. The feed is driven by a motor actuated by a weight. A diaphragm pressure control is used in connection with the motor to regulate the feed and maintain proper pressure in the generator. The feed shaft bearing is protected by a dustproof cover which protects it from carbide dust. Two changing doors facilitate filling the hopper. For maximum durability, some gears are made of bronze and Monel metal and certain shafts are of special alloys. The brake control on the motor is positive in action and does not require frequent adjustment once it is set.

When recharging is necessary, the interference, which is of simple and sturdy construction, operates the relief valves, locks the feed motor so it cannot operate, and permits the carbide doors and water filling cock to be opened.

This generator uses 1¼x⅜ in. carbide. The overall height is slightly over 120 in. and the height to the top of the generator shell is 104 in. The diameter of the shell is 42½ in. Shipping weight 2,300 lbs.

I. O. C. PURCHASES TARIFFVILLE OXYGEN

The International Oxygen Company of Newark, New Jersey, has taken over the business of the Tariffville Oxygen and Chemical Company of Tariffville, Conn. This plant will be conducted by a newly formed company, the Tariffville Oxygen Company, as the New England division of the International Oxygen Company.

The Tariffville Oxygen Company will continue to manufacture Oxygen, Hydrogen and Acetylene at Tariffville and handle in addition the other products of the International Oxygen Company: Nitrogen, Primogas, Compressed Air and Liquid Air together with the complete International Oxygen Company line of "International" and "Eyeosee" welding and cutting apparatus and supplies.

NEW CIRCULAR ON TUBE-TURNS ISSUED

The Pipe Bending Process Company, of Louisville, Ky., has recently prepared for distribution a new two-color illustrated bulletin, No. 101, which gives an interesting description of Tube-Turns and the process by which they are manufactured. Suggestions are offered for the application of these products in the piping industries, and a complete table of data and specifications on standard and extra heavy iron pipe sizes is included. This circular should be of interest to all those who use pipe connections and pipe bends, as the manufacturers claim the elimination of screwed fittings, flanged fittings, and mitre-welded bends through the use of their Tube-Turns cut and welded in at the required locations.

ELECTRONIC TORNADO WELDER FOR WELDING SMALL TANKS

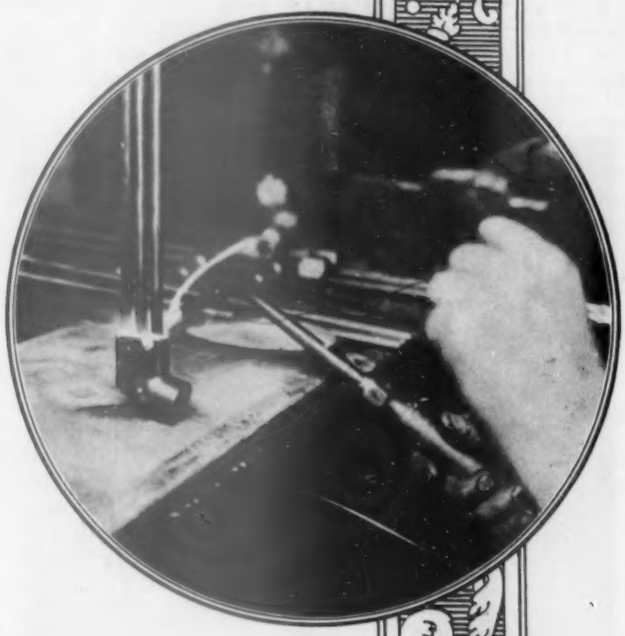
A new automatic arc welder for welding the head in small tanks, such as range boilers, oil and gas tanks, etc., utilizing the Electronic Tornado principal is illustrated in the photograph reproduced below.

This machine is characterized by its extreme simplicity. The holding fixture consists of a rotating table driven by a small variable speed motor and a vertical support carrying a fixed steady rest and the welding head.

The Electronic Tornado welding head is flexibly mounted so that the length of the arc is at all times under the control of the operator. The chief advantages claimed for this machine are high welding speeds and smooth uniform welding speeds.

In making an edge weld as illustrated in the photograph, no additional filler metal is used. The heat of the carbon

"Handy" SILVER SOLDER for Parts that Encounter Heat in Service



by INVESTIGATOR

IN my tour 'round Chicago, a number of interesting facts were developed about uses of "Handy" Silver Solder.

Makers of oxy-acetylene blow torches, gasoline torches, plumbers' furnaces, factory cookers, creamery machinery, and other apparatus operating under heat find that

"Handy" Silver Solder

makes permanently gas-tight joints, does not corrode—and it withstands relatively high working temperatures.

Oxy-Acetylene Torches

A large manufacturer of oxy-acetylene brazing and cutting torches welds the "Am-Brac" metal tubes to the forged brass torch-heads, with "Handy" Silver Solder, as shown in the illustration.

The free-flowing properties, and the strength of silver solder insure a more permanently gas-tight joint than can be secured with hard solder. "Handy" Silver Solder also saves labor in this operation because it works faster.

Welding Torches

A leading brass working concern use "Handy" Silver Solder for securing copper tubing to the brass casting of the cutting attachment of their welding torches, also for soldering the tip of their welding torch to the body, and for sealing any leaks that develop during their tests of the spelter solder used in joints on a great variety of their brass products. The lower melting point of "Handy" Silver Solder permits its use on spelter-solder joints.

Gasoline Torches

A maker of patented gasoline blow torches with portable burners showed me how they solder a 5/16 in. Shelby seamless steel tube into the brass generator casting with "Handy" Silver Solder. It is used because the brass casting has a wall too thin to withstand the temperature of a brazing heat. Soft solder cannot be used because this part of the torch becomes very hot in use. Silver solder is also employed in sealing any leaks that develop in the brazing of brass studs into the steel tank. Similar applications are made in their line of plumbers' furnaces.

"Handy" Silver Solders

Flow freely, work fast, save labor, make neat, tight, permanent joints. They are offered in TWELVE standardized, tested, formulae, ranging from 10% silver up to 80%, and in melting point from 1600° F. down to 1325° F. Each of these mixtures is best for certain kinds of work. Our service department will gladly co-operate with you in determining the formula lowest in silver (and hence the least expensive) which will best do your work. Send samples of parts you solder in quantities, or write fully.

Send for our "Handy" Silver Solder Booklet W

HANDY & HARMAN
EXECUTIVE OFFICES
57 William Street, New York

PLANTS

Bridgeport, Conn. Providence, R. I. Fulton and Gold Streets, New York City

arc fuses the edges of the cylinder shell with the flange of the dished head making a leak-proof joint.

Welding speeds of 100 to 150 lineal foot per hour are claimed for this machine which is manufactured by The Lincoln Electric Company, Cleveland, Ohio. It will be noted that the framework of the machine itself is constructed entirely

Welding Small Tanks with Electronic Tornado.

from welded steel. This type of construction has been used for a number of years by The Lincoln Electric Company in their standard line of motors and welders and was naturally followed in bringing out a new line. This machine is but one of the many applications of the Electronic Tornado principle developed by the Lincoln Research Laboratories and announced in this publication several months ago.

LINCOLN SALESMEN GATHER TO VIEW NEW WELDING EQUIPMENT

Doors of the Lincoln Research Laboratories, Cleveland, Ohio, were thrown open September 14th and 15th to the salesmen of The Lincoln Electric Company who came from all parts of the United States and Canada to view the important new developments in the design of electric arc welding equipment. Demonstrations and comparative tests were made before the assembled salesmen showing the improved performance and the increased ease of operation of the newly equipped "Stable-Arc" welders. The radical changes in the design of the new equipment displayed spectacular engineering on the part of the company's research engineers and it is believed will cause much favorable comment when the new developments are announced to the trade.

The wide range of application of the Electronic Tornado principle to automatic arc welding was also demonstrated at the sales convention. This new carbon arc process of automatic welding which was recently announced to the trade by the Lincoln Electric Company is featured by the high quality of its weld and speed of welding metal of every thickness.

NEW TOOL MATERIAL IS DEVELOPED IN GENERAL ELECTRIC LABORATORY

Cutting a screw thread in a glass rod, boring a smooth hole in a block of concrete, handling porcelain on a lathe, and cutting the hardest of steels—things difficult or even impossible with present-day machine tools—are among the things that can be done easily with a new kind of machine tool material announced by Dr. Samuel L. Hoyt of the Research Laboratory of the General Electric Company at the annual convention of the American Society for Steel Treating, at Philadelphia on October 11. The new material, named Carboloy, is composed of tungsten carbide and cobalt, the carbide being extremely hard and the cobalt giving it the necessary strength for cutting tools.

The possibilities of the new tool material were indicated by Dr. Hoyt in his references to experiments conducted with molded materials containing metal inserts, such as fabric gears used in automobiles. Cobalt-chromium alloy cutters, which had given the best previous service in this work, required redressing for every 150 parts machined; the new tungsten carbide tools, operating under identical conditions, finished 11,000 parts before they required sharpening.

"The peculiar virtues of tungsten carbide promise to make it the dominant tool material in the field of weak or 'low tensile' materials, which are also uncommonly abrasive to present tools. Here the durability of Carboloy tools has been found to be of the order of 25 to 75 times that of high speed tools," Dr. Hoyt said. "The new material can machine harder and denser grades of steel than can be handled economically by high-speed steel; and steels with higher alloy contents than are now commercially machinable will be brought into the machinable class."

Hadfield's manganese steel, previously in the non-machinable class of metals, was found to yield so easily to the new cutter that commercial operation is expected to be developed. Similarly, in the General Electric research laboratory it has been found that numerous experimental alloys can be handled by tungsten carbide cutters, although not with the usual tools. It was found that even a block of quenched high-speed steel could be machined on the shaper with the new material, although with difficulty, and that the same held true with the super-high speed cobalt-chromium alloys.

In testing high-speed steel it is customary to use a nickel-steel test log, operating at about 50 feet per minute. Because of the lack of effect on the new cutter, however, it was necessary to increase the speed to 200 feet per minute. At this higher speed a high-speed steel cutter failed in 16 seconds, with its edge burned off. The tungsten carbide tool, operated under identical conditions, was run for an hour before the test was arbitrarily stopped, and the tool was still cutting and capable of cutting for a much longer period of time. In another run with a test log of chromium-nickel steel, with a cut of $\frac{3}{8}$ inch and a feed of $\frac{1}{8}$ inch, good high-speed tools failed in from six to eight minutes when operated at 35 feet per minute; Carboloy tools, with the same cut and feed but at 70 feet per minute, twice the speed, showed but little wear after 10 minutes.

The material retains its strength and hardness at elevated temperatures to a remarkable degree. Tools have been observed cutting nickel steel when the point of the tool was at a bright red heat, without showing any ill effects. The material has no "temper" to be "drawn" by the heat generated, and it is actually much harder than the materials machined, even at elevated temperatures. Steel tools, on the other hand, are frequently softer than the machined materials.

Carboloy was displayed and demonstrated by the Carboloy Company, Inc., at the Philadelphia exposition, and attracted considerable attention. Announcement has been received that the company has established general offices at 1 River Road, Schenectady, and at 350 Madison Avenue, New York.

WESTERN METAL CONGRESS WILL SHOW NEW USES OF X-RAY

Mention of the X-Ray ordinarily brings to mind the use of the X-Ray photograph to locate a fractured bone, a spot in a patient's lung or for some other purpose in the medical profession.

True, the X-Ray is still extensively used for these purposes. But it is being used in industry in precautionary moves and quite generally.

One important use of the X-Ray in industry will be demonstrated when the Western Metal Congress assembles at Los Angeles for the first Western States Metal and Machinery Exposition in the Shrine Auditorium, January 14 to 18

In these demonstrations photographs will be taken of cast iron. It has been found that the X-Ray machine will indicate on its negatives where there are flaws in metals. Where iron and steel are used in construction of great buildings, automobiles and aircraft, it is well that the metals be perfect. Only such a machine as the X-Ray can detect the flaws in a metal and the defective material then can be cast aside as it would not take the required strain, and once giving way might cause a tragedy.

It will be interesting to see men shooting rays through iron castings in this work of detection.

Scores of other modern appliances now essential in mining, oil field work and the manufacturing industry will be displayed and demonstrated at this exposition which will be of importance to every industry on the western coast, for what industry progresses without metals?

This exposition and Western Metal Congress will bring to Los Angeles the leading scientists of the metals field of the western states as well as hundreds of executives in industry who always are eager to keep abreast of developments in their field.

Five days will be devoted to technical sessions on the making, working and treating of metals. The exposition will include displays of machinery, materials and appliances which will portray a complete cycle of the metal industry from the raw material to the finished product. In many respects it will not be unlike the society's annual metal exposition held in Philadelphia October 8 to 12.

Papers of vast importance to industrial development will be read at technical sessions. Participating in these will be the following technical societies: American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, California Division of Development and Production Engineering of the American Petroleum Institute, American Welding Society, Society of Automotive Engineers, Pacific Coast Electrical Association, Pacific Coast Gas Association, Institute of Marine Engineers, Metal Trades and Manufacturers' Association, Chamber of Mines and Oils, National Purchasing Agents' Association and the American Society for Steel Treating.

The rapid development of various industries in the western section of the country where the consumption of steel products has become so great and important makes the coming of the first Western Metal Congress and Exposition of exceptional importance to every part of the West. The value of the sessions cannot be estimated and hundreds of leading authorities in metals will be there as well as hundreds eager to obtain knowledge of the latest developments.

FOR WELDING CHROMIUM STEELS

A welding shop which has had very satisfactory success in the welding of chromium steels recommends the use of a flux composed of one part boric acid and one part borax, made into a paste with zinc chloride. This is smeared on the parent metal as well as the rod, which is recommended to be of the same analysis.

GIVES TALK BEFORE CLEVELAND WELDING SCHOOL STUDENTS

Mr. E. N. Stevens of The Bastian-Blessing Co. gave a talk on Oxy-Acetylene welding before the classes of the Cleveland Welding School on September 28th, 1928.

Mr. Steven's talk was highly enlightening, tracing the growth of the industry as observed by himself over a period of twenty years. Following his talk he led the classes in a general welding discussion. The discussion covered general pipe welding, structural steel, general plant maintenance, and cast iron cutting.

A HINT FOR BRONZE WELDERS

Welders who have had some difficulty in getting sound deposits when attempting bronze welds on cast iron or steel will be interested in a suggestion received from an operator who has had not only a lot of experience but also a lot of success. He avoids flat welding positions as far as possible, arranging his set-up so that the line of weld is on an incline, and working it up from the bottom. In this way he avoids having the molten bronze run over on metal which is not hot enough to alloy with it and then having to melt through this layer of bronze in order to bring the parent metal up to the welding heat, with the danger of burning out the zinc. With a little practice this also makes possible shape welding without the use of molds.

STORTS HAS ANOTHER NEW ONE

The Storts Welding Company, of Meriden, Conn., has hit upon a rather effective way of keeping the Storts telephone number before prospective customers of the shop. This consists in sending out a little clip which fastens to the telephone instrument and holds a pencil handily in place for instant use. Of course the clip carries a name plate with the phone number of the sender well displayed. A neatly printed letter accompanies each one, and it is reasonable to assume that Meriden 1991 will get a ring when someone says, "Phone for a welder."

News of the Welding Trade

E. C. Smith, vice-president of the Harrisburg Pipe and Pipe Bending Company, has been appointed as a member of the Cylinders Testing Committee of the Compressed Gas Manufacturers' Association. The Harrisburg Company heretofore have not taken active part in the discussions but it is now their intention to enter into these matters actively and Mr. Smith will aid the committee by giving it the benefit of their experience in steel and cylinder making of over twenty years.

The Compressed Gas Manufacturers' Association is preparing to issue a new edition of the membership directory to cover the periods of 1928-1929. Manufacturers in the industry will receive requests for information desired to bring listings in the directory up-to-date. An interesting addition to the directory plans for the new edition is information regarding the personnel.

J. C. Menzies has recently been appointed district manager of the Koro Corporation, Waukegan, Illinois, for the Cleveland district, with headquarters at 429 Union Building, Cleveland, Ohio. Menzies covers considerable territory by automobile and uses his spare tire cover for advertising space to let everybody along the road know that a Koro representative is on the job.

"STANDARD"
Welding Wire
GAS AND ELECTRIC
A grade for each type of work—send for samples.

for sound permanent welds : : lower costs
Our costs are considerably under those of large industrial centers; ours is a one-profit wire sold direct to user from our own mills exclusively devoted to making of welding wire from raw material to finished product—hence our extremely low prices for wire that is definitely superior. Adopted exclusively by many large users.
Prices on request.
Standard Steel & Wire Co., Greensburg, Pa. (Mills at Bolivar, Pa.)

HARRISBURG SEAMLESS STEEL CYLYNDERS

DR. H. E. STÜRCKE'S "OVERFLOW" TEST JACKET

Stainless Iron and Steel Forgings, Tubes, etc.
CHARLES L. GULICK, 110 E. 42d St., New York.

Notice has been received of the incorporation of the Cincinnati Electric Welders, Inc., by L. G. Palmer, L. J. Brumleve, Jr., and L. E. Palmer. This is a $100,000 corporation with 4,000 shares of no par value stock.

John C. Taylor, general sales manager of the Taylor Wharton Iron & Steel Company, has resigned effective September 30, 1928. It is reported that he contemplates going into business for himself, locating in Houston or Ft. Worth, Texas.

E. J. Henke, president of the American Electric Fusion Corporation, Chicago, manufacturers of resistance welders, owns and operates his own airplane which he has christened "Wings of Welding." Mr. Henke used his plane to make a real flying trip from Chicago to visit the recent Metal Trades Exposition at Philadelphia.

A new plant of the Linde Air Products Company, located at 125 Settlement Street, Akron, Ohio, started producing oxygen on September 11. This plant will supply the nearby demand for oxygen used in welding and cutting by the oxy-acetylene process. The addition of this plant to the Linde chain brings the total up to fifty-four. This plant will be operated under the direction of A Deagon, superintendent.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address.

Wanted—Young man of sound reputation, integrity and business ability for the selling of electric welding equipment in Detroit territory. Applicant should have some knowledge of production work in automobile and kindred lines. Remuneration will be controlled by your ability. Reply by letter only and appointment for interview will be arranged.

Gibb Welding Machines Company, 10-230 General Motors Bldg., Detroit, Michigan.

Lewis Seam-Welding Head
PATENTS PENDING
Fits Any Spot-Welder
Proven by 3 Yrs. Use

Will weld *side seams* or *bottoms* of buckets, pails or tanks at 15 to 25 ft. per minute and make joint water and gas tight.
Change from "Spot-Welder" to "Seam-Welder", or the reverse, made in 5 minutes.
One user has made over 1½ million 3 inch lap joints and then nickel plated the piece. **You can't find the joint.** No change to your spot welder — simply clamp Head to upper horn. Bolt on the proper electrode for either transverse or longitudinal welding. The "drive" is a separate unit and NOT attached to spot welder.
Send at once for Bulletin 129.
WELDING APPLIANCE CO.
2111 West Lake St., CHICAGO

Wanted—Responsible and experienced organization to take exclusive representation for a well established line of equipment for oxy-acetylene welding and cutting manufactured by a well established company in France. Address Box 161, care of The Welding Engineer.

One Dollar will increase your earning power by bringing you any one of the following GUARANTEED FLUX FORMULAS—Cast Iron—Brazing—Copper—Nickel—High Speed Steel—Aluminum (sheet and cast). With instructions you can make up your own fluxes fresh. R. N. Robbins, 38 Winans Street, East Orange, N. J.

For Sale—Acetylene Welding Equipments as Listed Below:

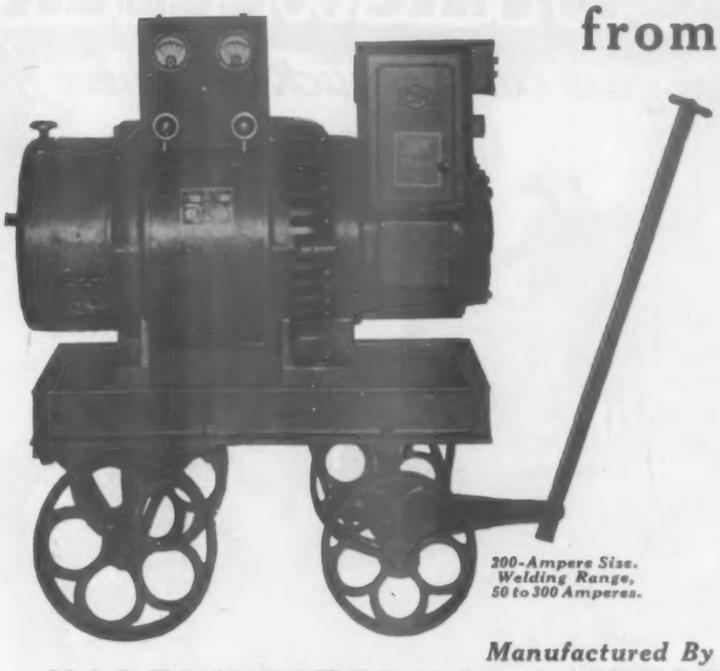
2—300#	Acetylene Generators	$300.00 each
2—100#	Acetylene Generators	200.00 each
1—20—outlet	Manifold and two (2) 300# Oxygen Regulators	75.00
13— 50#	Oxygen Regulators, D-B	5.00 each
12— 50#	Oxygen Regulators, D-B	5.00 each
9— 15#	Acetylene Regulators, D-B	5.00 each
12— 15#	Acetylene Regulators, D-B	5.00 each
11—	Gas Savers	8.00 each
11—	Welding Torches (Oxy-Acetylene)	5.00 each
1—	Water Seal	20.00
2—	Bursting Discs	8.00 each

These equipments are available for inspection at the Sharon Works of the Westinghouse Electric and Manufacturing Company and are offered subject to prior sale.
Address Westinghouse Electric & Manufacturing Company, Sharon Works, Sharon, Pa.

AMERICAN STEEL ENGINEERING COMPANY
3520 Queen Lane, Philadelphia
601 Granite Bldg., Pittsburgh

GE Arc Welders, GE Electrodes: TYPES A, B and F
Four Reconditioned General Electric Arc Welders. Price, $300.00 and Up.
Page-Armco Welding Wire and Electrodes
Write to nearest office for descriptive circular and prices

You Get a *Peppy* Welding Arc from the HANSEN



200-Ampere Size. Welding Range, 50 to 300 Amperes.

"Peppy" is the word. A Hansen-generated arc goes at the job as though it means business. Surprisingly easy to control, because it is not broken by quick changes in arc length, it continuously accommodates itself and keeps right on the job. Push the arc as hard as you like. The whole secret lies in the electrical design of the generator—which also accounts for the fact that the Hansen can be operated all day at full capacity without over-heating.

(After being in production less than four years, the Hansen recently broke all records for the largest single order of arc welders. 92 machines to one company!)

Manufactured By

NORTHWESTERN MANUFACTURING COMPANY

Clinton and Madison Streets **Milwaukee, Wisconsin**

---*for* Strong welds

TRADE MARK REG. U. S. PAT. OFF

Nichrome

---*the exceptionally strong* Welding Rod

Welds made with "Nichrome" the nickel-chromium alloy, possess exceptional strength. For example, practical tests of welds on mild steel made with "Nichrome" rods, show an ultimate tensile strength as high as 55,000 pounds per square inch. It is interesting to note that the welding operation does not detract from the metal itself.

"Nichrome" welds are readily machinable and may be applied by either the oxy-acetylene or arc welding process. The ease of application and free flowing qualities of "Nichrome" welding rod, together with the fact that it can find wide application, makes its use extremely desirable.

Sample?

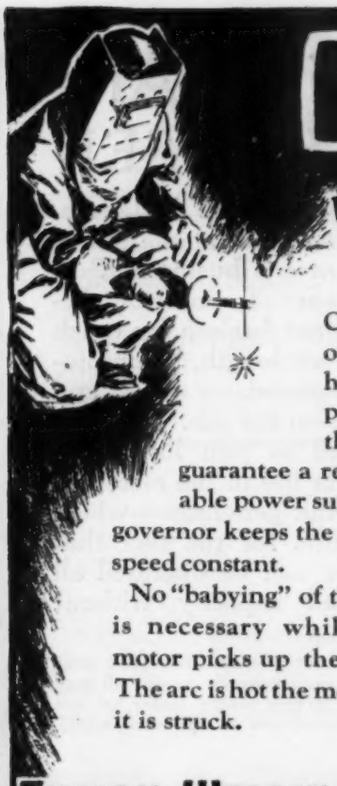
If you are having difficulty in getting a strong weld, we are sure "Nichrome" will prove satisfactory. *Sample rods will be sent on request.*

DRIVER-HARRIS COMPANY

HARRISON, NEW JERSEY

Chicago - Detroit - Morristown, N.J. - England - France

Alloy Makers since 1899



FUZON ARC WELDER

will follow your car or truck anywhere!

GAS ENGINE DRIVEN

No Exciter—No External Stabilizer

A bulletin describing the novel features incorporated in this machine will gladly be sent to you upon request.

Continental Motors of ample power—23 h.p. for the 200 ampere and 40 h.p. for the 300 ampere set—guarantee a reliable and dependable power supply. An automatic governor keeps the motor speed constant.

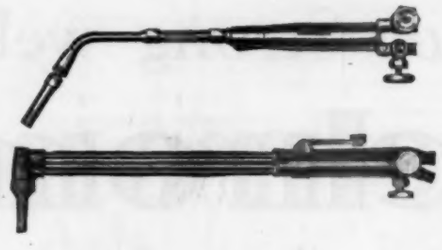
No "babying" of the arc is necessary while the motor picks up the load. The arc is hot the moment it is struck.

FUSION WELDING CORPORATION

Welding Equipment and Supply Division of Chicago Steel & Wire Company

Engineers—Manufacturers—Merchants

103rd STREET AND TORRENCE AVENUE, CHICAGO



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WHEN you are equipped throughout with K-G Regulators and Torches you are equipped with the best money can buy.

They are substantially built and will last and stand up under the severest treatment. Carefully made and assembled and scientifically and correctly designed after our years of experience and experimenting.

Torches of every size and principle for any use or requirement.

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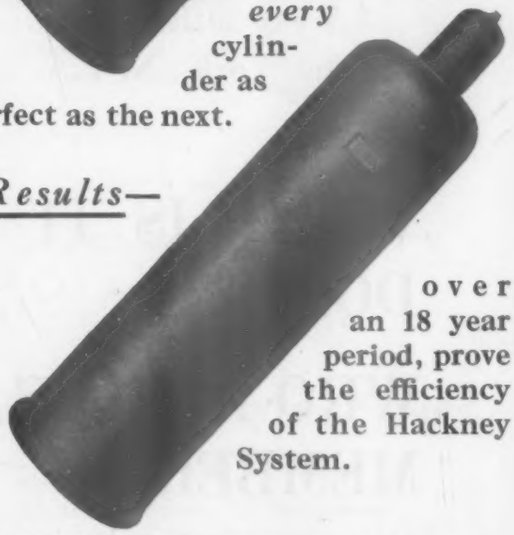
Hackney Acetylene Gas Cylinders are uniformly good because—specially designed equipment—skilled workmen—

—careful inspection of *each* cylinder, after *each* operation in the productive process—

—and systematic tests run at regular intervals—make *every* cylinder as perfect as the next.

Results—



over an 18 year period, prove the efficiency of the Hackney System.

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YOU insure the quality of your welds—toughness, strength, uniformity, non-porosity—by using Bronzeweld. Bronzeweld fuses quickly, melts at a low temperature and flows evenly and smoothly. Laboratory controlled to insure superior quality. For welding Bronze or Brass and brazing Malleable Iron or Steel parts.

A Rod for Every Job

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Large stocks of welding rods—both gas and electric—are carried in our Chicago plant for immediate shipment.

WILSON COLORTIPT	HIGH MANGANESE
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We do— ☐ Elec. ☐ A. C. ☐ D. C. ☐ Acetylene welding

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STOODY ELECTRODE HOLDER

speeds up welding

THE STOODY Electrode Holder represents a great advance in electric welding. It completely eliminates slipping and twisting and permits the instant easy changing of electrodes.

This remarkably efficient tool is of rigid one-piece construction and has no springs, levers, screws or slides to become corroded or work loose. It is of three prong design and new electrodes are inserted in an instant by simply placing the rod between the first two prongs, then bringing it to a right-angle position. This operation also ejects the used stub, thus accomplishing two operations in one.

The Stoody Electrode Holder is constructed of a special steel, selected for its high conductivity, thus, giving maximum results from the current as well as insuring long life for the holder. It is equipped with 30 inches of extra-flexible welding cable, assuring great ease of operation.

Write Dept. C-4 for full information. Learn how to cut your costs by speeding up operations.

STOODY COMPANY

Manufacturers of WELDING ROD • ALLOY STEELS • EQUIPMENT • *Whittier, California*

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"Electro Weld"

"Gas Weld"

These rods are made from specially selected stock and processes. Uniform Temper, Analysis, Gauge and Finish.

Special Soft—Medium Hard — Extra Hard

Seneca Rods are shipped to you in coils, or in straight lengths as you wish, in:—

Black—Bright—Copper-ed Finish Flux Coated

Your inquiries will receive prompt attention.

The Seneca Wire Mfg. Co.

Established 1905

Fostoria Ohio

American Welding Society
33 West 39th Street
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WHO ARE ITS MEMBERS?

The Secretary has a copy of the Membership Directory for you. Write for it.

Uniform Quality Assured

WELDERS who use Commercial Acetylene soon learn that every cylinder contains the same pure gas.

Your torch can tell the difference!

COMMERCIAL ACETYLENE
Means pure acetylene.

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Means prompt service.

No matter what your gas requirements may be you will be interested in our sales plan. Ask our nearest office to tell you about it.

Supplied in the following size cylinders:

10x30-in. size	125 cu. ft. cap.
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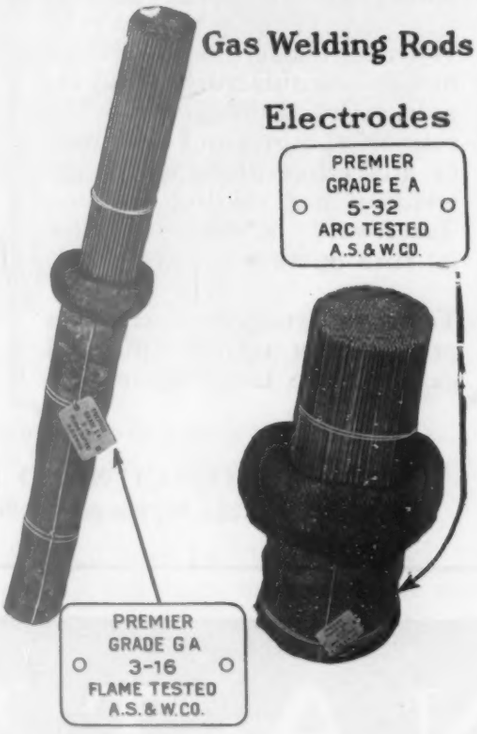
American Steel & Wire Company's

PREMIER

TESTED

WELDING WIRES



PREMIER Welding Wire flows freely, giving perfect fusion, thorough penetration and the desired finish. The uniform quality of Premier Welding Wire insures a deposit of metal in the weld free from foreign inclusions and possessing maximum strength. Before shipment, every bundle is electrically tested and manually welded. Permanently satisfactory welds and a saving of gas, electricity and the welder's time are thereby assured.

For a dependable welding job, use an appropriate grade of Premier Welding Wire. Send for booklet giving full information and specifications.

American Steel & Wire Co.

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CINCINNATI.....Union Trust Bldg.	BALTIMORE.....32 So. Charles St.
MINNEAPOLIS—ST. PAUL.....	BUFFALO.....670 Ellicott St.
....Merchants Nat'l Bank Bldg., St. Paul	WILKES-BARRE.....Miners Bank Bldg.
ST. LOUIS.....506 Olive St.	DALLAS.....Praetorian Bldg.
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Torchweld ruggedness is indicated by Performance, economy, safety and low upkeep expense and have proved their ability to stay on the job.

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Torchweld rugged construction protects you against time and gas loss also large repair bills.

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COAST TO COAST

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Best for
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Saves You Money

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Pretesting ends protesting

By pretesting every batch of WISSCO Welding Rods for quality and uniformity, we insure against protests from users. Results are invariably satisfactory.

The users of WISSCO Rods get double portions of benefits. Their welds are always right and they have the call on an engineering and metallurgical department with the broadest experience in welding problems and factory costs.

Wickwire Spencer Welding Engineers will prescribe the rod or wire that will do your job better. They will show you how to practice peak economy and insure uniform results.

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Now

get your *better* welding wire this *better way*

Page Welding Wire and Electrodes are now available in handy packages especially designed for the garage and small job welding shop.

All you have to do to get this better wire is tell your distributor the grade you need. You will get exactly what you want—quickly and conveniently. What is more—the carton will eliminate any chance of the wires being mixed.

You can easily prove for yourself the efficiency and economy of Page Welding Wire and Electrodes in this new package form. Write for the name and address of your distributor. He will recommend the grade best suited to your work.

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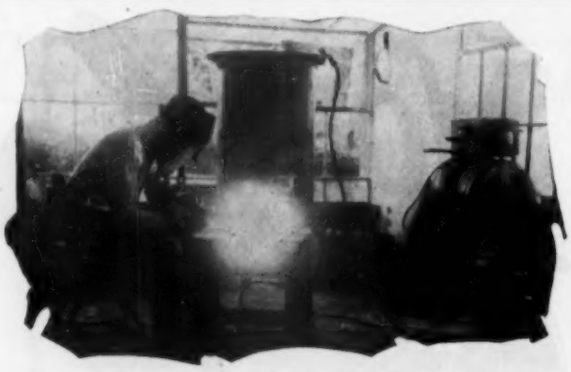

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Brings The Best In Arc Welding To Your Shop

Now the small shop with limited finances—or the big shop that wisely buys equipment on a "Show Me" basis—can have all the advantages of Electric Arc Welding without a big outlay of cash or upsetting of the budget.

To prove that an HB Constant Arc Electric Welder will effect big economies in your work—giving you speed and other advantages impossible with other welding equipment—HB comes to you on 30 Days Trial in your own work—at our risk—under our absolute moneyback guarantee.

And after proving to your entire satisfaction that it is the kind of welding equipment you need, you can continue to profit from its use WITH PRACTICALLY NO INVESTMENT ON YOUR PART. HB's easy payment plan lets it pay for itself out of the savings and increased profits it brings you.

Of course you want to know more about the Arc Welder that's offered on such a basis that proves its manufacturer's confidence in its continued successful performance. Mail the coupon below for full information.

HOBART BROTHERS CO., Box V108, Troy, Ohio

Hobart Bros. Co., Box V-108, Troy, Ohio: Send me, without obligation, full details of the HB constant Arc Welder, the 30 Days Trial Offer and the Easy Payment Plan.

NAME..... ADDRESS.....

Big Jim (Master Welder)

says:

If hundredths of inches meant dollars to you, you'd want to know about it, wouldn't you? Well, if you'll just write the FRE-FLO folks they'll send you further information without obligation.

Also ask for a free sample of FRE-FLO to try in your shop.

Big Jim (MASTER WELDER)

FRE-FLO Rods are sold only through distributors. A few desirable territories are still open. Correspondence from distributors is invited.

The Atlas Foundry Company
Dept. "A"
W. 69th & W. & L. E. Ry. Cleveland, O.

-DON'T STRIKE A MATCH-

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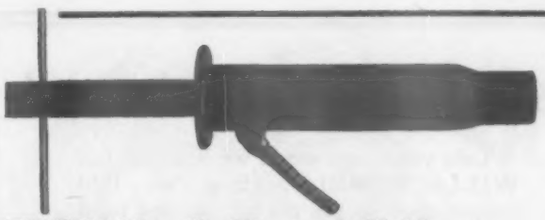

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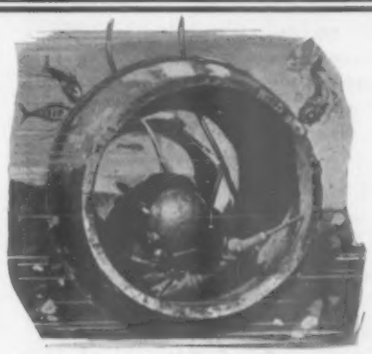

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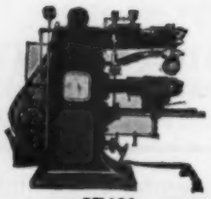

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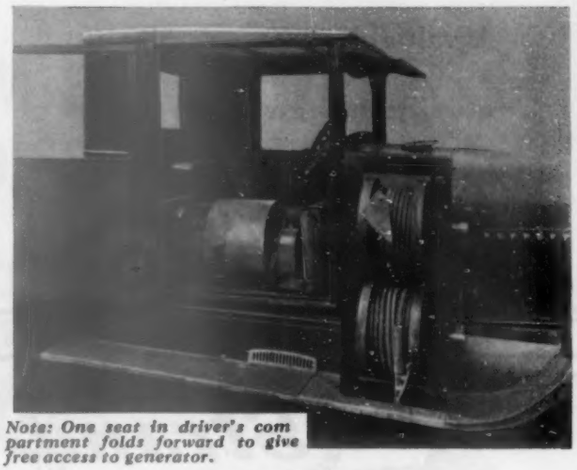

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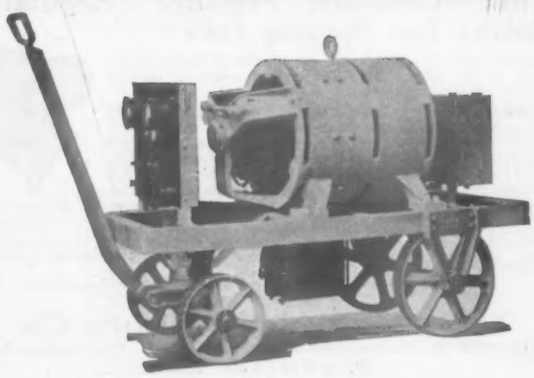

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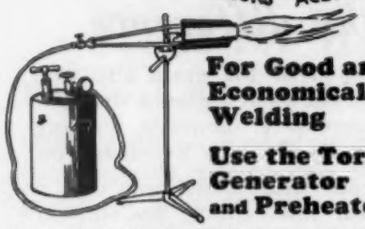

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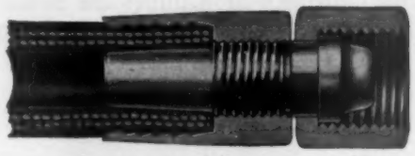

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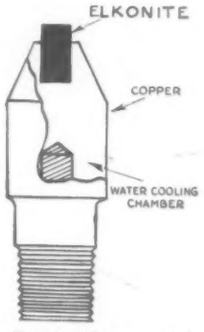

Fig. 1. Water cooled spot welding electrode showing Elkonite Insert. (Courtesy General Electric Co.)

The variable electrical and heat resistance of the different grades of Elkonite Welding Electrodes, plus their ability to hold their shape without mushrooming under red heat, heavy pressures and high currents are properties of immense value.

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BRASS			•	•	•	•		•	•	•	•	
COPPER		•	•	•	•	•		•	•	•	•	
GALVANIZED IRON		•	•	•	•	•		•	•	•	•	
IRON		•	•	•	•	•		•	•	•	•	
LEAD							•					
MONEL		•	•	•	•	•		•	•	•	•	
NICKEL		•	•	•	•	•		•	•	•	•	
NICHROME		•	•	•	•	•		•	•	•	•	
TIN PLATE		•	•	•	•	•		•	•	•	•	
ZINC												•

Fig. 2. Combinations of metals successfully welded with Elkonite. (Courtesy General Electric Co.)

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